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Department of Economics

Assessment of Russian Embargo Impact on Economies of the EU Countries

- An Input-Output Approach

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Abstract

The purpose of this study is to quantify the impact of Russia's embargo on the economies of most affected EU countries. Russia is the fourth largest trading partner and the second largest importer of Europe's agriculture products. According to the Eurostat, Russia's food import counts approximately 10% of Europe's total export of agriculture and food products. In June 2014, the European Union (EU) adopted a series of economic sanctions against Russia due to the Ukraine's territorial crisis. As retaliation, Russia imposed a one-year food embargo on the import of a whole range of food products from the EU, Norway, Australia, Canada and the USA on 7 August 2014. In June 2015 the ban was extended to be effective until August 5, 2016, and it may be subsequently extended for another 1-year period. The most affected European countries are: the Baltic States, Finland, Poland, and Germany (as shown in the database of GTAP 2011). The impact of Russia's counter-sanction on the economy of the EU countries is assessed in this study by conducting Input-Output multiplier analysis together with comparison studies. In order to allow a holistic view of the impact on the interested regions, the disaggregated Input-Output matrix for those four European countries of interest is constructed from the dataset of the Global Trade Analysis Project (GTAP) in 2011. The results show that the impact on the whole economy of these four countries is moderate in terms of their change in GDP, but it does have significant negative impacts on certain industries of each economy, for instance, bovine meat industry in Germany, vegetables and fruits in both Baltic States and Poland, and dairy products in Finland. These impacts on production level may further forward its negative effects to the related labors and firms who run the risk of losing their income due to the embargo.

Keywords: Russian Embargo, GTAP model, An Input-Output multiplier analysis, direct and indirect effects, economic impact analysis

Abbreviations:

EU	European Union
US	the United States
MRIO	Multiregional Input-Output model
IO Model	Input-Output model
CGE Model	Computable general equilibrium models
GTAP	Global Trade Analysis Project
SAM	Social Accounting Matrix
GDP	Gross Domestic Product
VA	Value Added output

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Chapter 1 - Introduction

Nowadays, the Ukrainian Crisis has been extended to the trade war without smoke of gunpowder since Russia announced a ban on food imports from Western countries on August 7th, 2014. Farmers and exporters in affected countries of European Union are facing intense competition from the rest of the world in the international market. It is important to have a clear measurement to quantify the impact of Russia's embargo on the economy of the EU countries and provide a guide to the policy makers.

1.1 General Background of Embargo

An embargo is a partial or complete block of commerce and trade with a particular country or a group of countries, usually imposed by one nation against the others as a diplomatic tool. According to Palánkai (2014), Embargo can be in a form of limiting or banning export or import, creating quotas for quantity, imposing special tolls, taxes, banning freight or transport vehicles, freezing or seizing freights, assets, bank accounts, limiting the transport of particular high technologies or products.

Embargo is one type of economic sanctions. Economic sanctions as one of the main strategies of international economic pressure can be distinguished as three types: trade sanction in forms of total or partial embargoes; investment or financial sanctions and more narrow-targeted sanctions called smart sanctions (Kaempfer and Lowenberg, 2007). Table 1 shows the content of different type of economic sanctions. Embargo belongs to the category of negative sanctions.

Table 1 Definition and Types of Sanctions

Economic Sanctions		
Means to express power and to foster cooperation among countries		
	Positive Sanctions	Negative Sanctions
	Actual or promised rewards	*Actual or threatened punishment*
Trade Sanctions	• Tariff's reduction • Tariff's abolition	• Partial embargo • Total embargo
Investment or Financial Sanctions	• Financial or investment aid from different entities such as the International Monetary Fund, the World Bank or countries	• Restriction on capital flows • Mandatory disinvestment • Restrictions on international payments • Freezing of assets
Targeted sanctions	• Humanitarian aid	• Interdiction of transports • Interdiction of communication • Travel bans

Source: Mélanie 2013

The first embargo act was the Embargo Act of 1807. It was aimed to force Britain and France to respect American rights during the war of Napoleonic Wars, however, the historians have judged it as a failure. Another comprehensive attempt as an embargo took place on February 7th, 1962. The United States imposed an embargo on Cuba. It is one of the longest-standing embargoes. Although it is taken as a strong diplomatic tool to Cuba, but it turns out to be a double-edged sword and it hurts the business on both sides. The U.S. Chamber of Commerce estimates that the embargo costs the U.S. economy $1.2 billion per year in lost sales and exports, while the Cuban government estimates that the embargo costs the island itself $685 million annually. Until December 2014, the United States announced that it would reestablish

the relations with Cuba and intended to ease the trade and travel restrictions currently in place. These cases of import embargoes show that when nations have been engaging in economic collaboration in the recent past, businesses on both sides tend to suffer a lot from the embargo (Prableen, 2014). The most recent case is the international sanctions during the Ukrainian Crisis.

1.2 General Background of Russia's Embargo

Recent political tension has been raised by the conflict of Ukraine's territorial integrity between the EU and Russia. As a result, the EU and the US has introduced a series of economic sanctions on Russia in its energy sector since March 2014. Those sanctions set restrictions on lending money to the banks of Russia, an embargo on arms, an export ban on the oil technology and services and an export ban on dual-use goods. In a specific way, the U.S. sanctions banned American companies from conducting commercial activities with oil and gas drillers in Russia. The EU sanctions banned Rosneft, Gazpromneft and Transneft (Russian energy companies) from raising long-term debt on European capital markets. The EU also restricted services that Russia needs to explore oil and gas in the Arctic and to conduct deep sea and shale extraction projects (Prableen, 2015). Since 2014 July, Canada, Japan, Australia, Norway, Switzerland, and Ukraine announced to impose sanctions against Russia successively. In addition, the EU extended its sanction list to cover 151 individuals and 37 entities and the US imposed sanctions on Crimea by prohibiting exports of the US goods and service to the region. Those economic sanctions are believed to further weaken the Russian economy given the challenges that Russia has been facing recently (Golubkova, 2014). The economy of Russia enters into a recession with -2.2% of GDP for the first quarter of 2015 compared to the first quarter of 2014.

In response to those sanctions, on March 20th, 2014, the Russian government published a list of sanctions against certain American citizens and thirteen Canadian officials from entering the country. On August 6th, 2014, Putin signed a decree which implemented a fully embargo for a one-year period on imports of most of the agricultural products from the United States, the EU, Norway, Canada and Australia. It includes a ban on beef, pork, poultry, processed meet, fish, seafood, milk products, cheese, vegetables, fruits and nuts (See Table 2). This is the so-called Russia's embargo. Prior to the embargo, food exports from the EU to Russia were worth around 11.8 billion euros. It counts 10% of the total EU food exports to Russia. Food exports from the United States to Russia were worth around 972 million euros and the food exports from Canada were worth around 385 million euros (BBC, 2014). After the embargo, the affected food export in EU could amount to 5.2 billion Euros (See Table 2). In June 2015 the ban was extended to August 5th, 2016, and it may be subsequently extended for another 1-year period (Presidential Decree No. 391 dated July 29, 2015).

Table 2 A List of Ranking of HS2 Codes affected by the Russian Food Import Ban in 2013

A List of Russian Food Import Ban	
HS Codes	**Exports Affected**
02 Meat and edible meat offal	1,168,346
03 Fish and fishery products	152,899
04 Dairy produce	1,347,072
07 Edible vegetables, roots & tubers	734,158
08 Edible fruits & nuts	1,257,557
16 Preparations of meat	55,000
19 Preps. of cereals, flour, starch, etc.	15,060
21 Miscellaneous edible preparations	472,532
Total	€5,202,625

Source: COMEXT, November 2014

1.3 Motivation and Problem Statement

Considering the trade dependency between EU countries and Russia in terms of direct trade flows in goods, Russia is the EU's fourth largest trading partner in general and the second largest importer of Europe's agriculture products (Latvijas Banka, 2014). Although trading with Russia only accounts for 2.66% of the total exports of the EU countries in 2011 (counted from the export trade data in GTAP), export to Russia is a significant part of the agriculture product trading to many European countries. For example Austria, Czech Republic, and Poland, the share of export to Russia can reach to 32.25%, 31.44%, and 27.01%, respectively in 2011 (See Table 3).

Table 3 Top 10 Export Share to Russia (million dollars)

Countries	Export to Russia	Export to the rest of world	Export Share to Russia
1. Austria	65805.4	204077.4	32.25%
2.CzechRepublic	49505.8	157443	31.44%
3. Poland	51455.6	190512.2	27.01%
4. Hungary	26851.9	114615.6	23.43%
5. Slovenia	6694.8	31510	21.25%
6. Netherland	82258.1	393345	20.91%
7. Slovakia	15488.5	75410.4	20.54%
8. Romania	12020.2	66189.8	18.16%
9. Luxembourg	13523.2	75987.8	17.80%
10. Belgium	62758.4	398765.5	15.74%

Source: GTAP Database 9

By further taking banned products into consideration, 33% exports of cheese, 28% export of butter and 29% export of fruits and vegetables in European region will be worst affected (see Kraatx, 2014). The most affected European countries include the Baltic States, Finland, Denmark, and Germany, given the share of targeted export to Russia (As shown in Table 4). For Baltic States countries, including Lithuania, Latvia, and Estonia, Russia even plays a critical role as an export destination. According to Lavijas Banka (2014), the export to Russia takes up 11% of GDP in Lithuania, 8% of GDP in both Latvia and Estonia. Table 4 shows that, in addition to these three Baltic countries, exports of certain countries like: Finland, Poland and Germany are also the major area affected by trade embargo of Russia (In this thesis, the first four most affected regions are selected to be studied). This is particularly true when the total amount of affected export in a monetary value is taken into consideration.

Table 4 Top 5 Banned Food Export Share to Russia (million dollars)

Banned Import Food	Export to Russia	Export to the rest of world	Export share to Russia
1. Lithuania	472	1389	33.98%
2. Finland	488	1516	32.19%
3. Latvia	60.5	506	11.96%
4. Poland	539	6003	8.98%
5. Germany	1052	22478	4.68%

Source: GTAP Database 9

There is a consensus among economists that economic sanction is responsible for suboptimal recourse allocation and welfare loss. Particular to an import embargo, it always leads to a re-distributional impact on both sanctioning and targeted country (Kaempfer and Lowenberg,

2007). The aforementioned embargoes, e.g., the Embargo Act of 1807 and the embargo between the United States and Cuba support the above statement.

Moreover, there is always a concern about how the situation will further develop and what the long-term consequences could be. For countries that are dependent on the export to Russia, the ban will cause economic effects not only on their production but also on labor and capital income, government tax receipt, and so on. Taking an example of exporters of cheese products, 33% of cheese from European exports embargoed to Russia implies that around one third of produced cheese for export in the EU will have to find new consumers and markets, either in domestic or in the third economic zone. Otherwise, the exporters of this industry may run a risk of losing their money due to the embargo. Thus, it is important to have a clear measurement to quantify the impact of Russia's embargo on the economy of the EU countries and provide a guide to the policy makers.

In order to quantify the impact of this embargo on the economy of the EU countries of interest, four Input-Output tables of Baltic States, Finland, Poland and Germany are constructed using GTAP data in this study. Then a simulation with full embargo on food import is conducted to study the economic linkages between the external shock and internal outputs of the EU-wide economy. Such an economic impact analysis could provide a great reference for policy makers and decision makers.

1.4 Objective of the Study

The main objective of this study is to quantify and compare the economic impact of Russia's embargo on four major affected European regions including Baltic States, Finland, Poland and Germany. In specific, this work aims at:

(1) To construct the Input-Output table of the economic structure for the studied EU areas using the database of GTAP 9.0.
(2) To Calculate the Input-Output multipliers from those constructed Input-Output tables and analyze the economic structure of each studied economy.
(3) To run policy simulation of fully banned food embargo by removing the affected export from total export of each economy and compare the impacts on the economy of four regions and assess the policy implications of the model.

1.5 Research Hypothesis and Limitations

In accordance to the main objectives, the methodology of Input-Output analysis in this study is based on four central assumptions. The reported study is based on the following assumptions.

- Fixed proportions/coefficients of production

It means that the use of inputs is proportional to the outputs of the firm, regardless of firm size. If inputs are doubled, so are the outputs. This assumption implies constant returns to scale. With such a constant returns to scale production, all inputs are perfect complements, the marginal product of every one of them is zero.

- Each sector produces only one good

It is, in other words, that there are no joint products. This assumption implies that no process produces more than one output. Otherwise, the joint products may cause difficulty in linear programing because every input is supposed to be regarded as a negative output in the model. Hence, IO model does not consider the possible benefits of joint production.

- No substitution among inputs

There is only one process used for the production of output. This assumption implies that there is no response to prices of inputs and no shift in resources between sectors (according to price shifts) in IO model. It excludes all opportunities about substitutability in inputs used.

- Excess capacity in all sectors

It means there is no lack of capacity within the economy. This implies that the economy is assumed to immediately satisfy the need of extra production inputs. Arbitrage is not allowed. Only the increased demand can drive the production increasing.

Given these four central assumptions, it is better to be clear that the limitations of this study. Due to the fixed proportion assumption, this study of Input-Output approach cannot be used to account for prices changes that may result from scarce resources. In addition, the Input-Output multipliers are studied in an open economy, which considers households as a leakage. That means this study is not going to cover the induced effect of household spending to the whole economy. Since the most recent updated year of dataset I could use is 2011, three years before the Russian embargo implementation, this could be counted as a time limitation. However, since it is a year still within five years before the embargo and what I need to do the simulation study must be a time period ahead of the external shock, this limitation of time won't show a significant influence on the quality of the simulation. At last, the effect of re-export of the embargo, e.g., exporting products may be exported to a third country then re-exported to Russia, is outside the scope of this study. More specific reasons of the limitations of Input-Output approach could be found in the following sector.

1.6 Methodology and Data Used

The most popular methods for the study of policy analysis similar to the work reported in this thesis are partial equilibrium system and general equilibrium system.

The Leontief technology characterized Input-Output analysis is classified as a general equilibrium system. Compared to the general equilibrium system, the partial equilibrium analysis is usually applied on the price effect of sectors of interest. These sectors of interest do not affect the other sectors of the economy. For example, a change in economic policy instruments for a particular sector, like subsidies in agriculture sectors in the EU could be well measured by the partial equilibrium models. However, when it comes to a quantitative analysis of direct effects and indirect effect of an external shock on an economy with a socioeconomic scale, partial equilibrium model is not sufficient. This is because partial equilibrium analysis cannot cover the interaction between different industry sectors.

Another proper choice of methodologies is Computable general equilibrium model (CGE model), which is a combination of features from both partial equilibrium models and general equilibrium models. According to Sadoulet (1995), the CGE models are based on the social accounting matrix with its multi-sectoral, multiclass disaggregation. They are close to the multimarket models that can response to the relative price changes. Additionally, the markets can reconcile supply and demand decisions in the CGE models. Therefore, the CGE models are taken as the best choice for policy analysis when all the socioeconomic structure, prices effects, and macroeconomic phenomena are important to the measurement. This is, however, not the case for this study, as the primary focus of this study is on the quantitative impact on the socioeconomic structure change.

The Input-Output table is the subset of a social accounting matrix table made of the activity account and commodity account exclusively. The multiplier analysis of regional Input-Output analysis shares some similarities with the CGE based macroeconomic multipliers analysis (Rebecca and Zoë, 2011). For example, they both come from the idea that cascading events

may occur given an initial change in economic activity. The more leakage of the economy exists, the smaller magnitude of multipliers is. However, IO multipliers cannot be used to substitute the Macroeconomic multipliers. This is because multiplier effect tends to be smaller for regional IO multipliers comparing to macroeconomic multipliers given the leakage effects. The size of macroeconomic multipliers is based on behavioral assumptions related to how individuals adjust their labor supply, consumption and saving decisions when there is an initial change of final demand. Therefore, these models of CGE models can account for supply constraints, while the IO multipliers only can use the same spending response for all types of changes in the regional final demand and it cannot be used to account for prices changes that may result from scarce resources.

Despite some of the restrictive underlying assumptions of IO model, one of its main advantages is that it can be a powerful tool to capture the impact of demand changes on productions of industry sectors within a region. It well meets the requirement to quantify the impact of an initial change in export caused by Russia's embargo on the studied economy. In addition, the CGE models commonly impose stringent requirement on model construction and data available given their complexity, while the IO multiplier analysis are relatively less demanding. Thus, in this study, the Input-Output multiplier analysis is adopted in this study. The CGE model could be left to the future studies.

In practice, the value of Input-Output multipliers depends on whether households are considered as a part of the endogenous processing sectors or a part of the final demand outside the regional economy. In the first approach, the model is defined as a closed economy model while it is defined as an open economy model of the second approach. In this study, the second approach is selected. The purpose is that the impact of embargo on the production linkage and value added output could be highlighted from the other effect induced by the household consumption. The household responding here is taken as a leakage and does not contribute the multiplier effects. When the household responding is excluded from the regional economy, the multiplier tends to be smaller than the multiplier in a closed economy since the closed economy adds the spending of income received by households to the total effect.

The dataset used in this study is GTAP dataset 9. It is a global based dataset. It models the world economy with a combination of detailed bilateral trade, transport and data characterizing economic linkages among regions and it can be applied as a key input to the applied general equilibrium analysis (Narayanan and Thomas, 2015). The current release of the GTAP 9 is updated to the year of 2011 as reference year including 140 regions and 57 commodities. Users can abstract IO table from the GTAP database for either single country or aggregated multi-countries models. The most updated year is 2011, within five years before the embargo. Since the simulation study must be a time period ahead of the external shock, the time period of 2011 is still a proper choice for this study.

1.7 Outline

The purpose of this study is to quantify the impact of Russia's embargo on the economies of most affected EU countries. The most affected European countries are: the Baltic States, Finland, Poland, and Germany. What would be the potential influence of the Russian embargo on these four economies? In order to allow a holistic view of the impact on the interested regions, the disaggregated Input-Output matrix for those four European countries of interest is constructed from the dataset of the Global Trade Analysis Project (GTAP) in 2011.
This study consists of six chapters. The rest of the paper is structured as follows: chapter two discusses the previous work on the topic of impact of Russian embargo on different economies. The methodology of Input-Output multiplier analysis is presented in chapter three. Chapter four introduces the data description and the structure of the economy of Baltic

States, Finland, Poland, and Germany. Policy simulation and the results are reported in chapter five. The conclusion and discussion part is presented in the last section.

Chapter 2 - Literature Review

The literature review first goes through the existing works and the technology of multiplier analysis. Then some previous studies of embargo are summarized in the second part. The related studies on Russia's embargo are reviewed at last in this section.

2.1 Concepts of Multiplier analysis

The origin of Multiplier analysis could be traced back to Richard Kahn's (1931) who described the relationship between investment and employment. The notions of direct employment and indirect employment are set up in the production of raw material required for the needs of new investment. Hall (2009) provided a detailed discussion on the relationship between government purchase and the growth of GDP by using estimated Keynesian multipliers. The article proposed a concept of employment multiplier for government expenditure during a period of high unemployment. The article shows that the multiplier linking government purchases to GDP is in the range of 0.7 to 1.0 and it could be affected by the markup price and wage elasticity.

The Input-Output models could be traced back to the 1758 in France with a relatively long history. The French economist Francois Quesnay first proposed a diagrammatic representation of the process of tracing sales and expenditure through a whole economic system. However, the Input-Output analysis is known by the world only after the work developed by Wassily Leontief. Thus, the Input-Output multiplier analysis is credited to Leontief (1941), who explored the relationship between Input-Output accounts and the national revenue functions. The main contribution of his article was to develop a set of national-level multipliers that are applied to estimate the impact of an initial change in final demand on an economy. Wassily Leontief received the Nobel Prize in Economic Science in 1973. Isard (1951) then developed MRIO (multiregional input–output model) model as a simplification or the earlier inter-regional Input-Output model and gave a spatial expression. The way he used to do estimations achieved greater popularity due to its less detailed data requirement.

Kananen (1990) demonstrates us how a visual, interactive dynamic multiple objective (VIG: Visual Interactive Goal Programming) decision support system, a multi-objective linear programming decision, can be used for analyzing Input-Output models. The author applies their methodology based on a short-term Input-Output table of Finnish economy to analyze the impact of sudden crisis on the economy. It turns out that the model they developed to find an optimal allocation of resources under circumstances of extreme scarcity could be applied as a decision aid in the crisis situations of energy crisis, a crop failure, a trade embargo on high-tech products, and a labor shortage due to increased military in Finland. This approach provides a new way to extend the traditional Input-Output models into optimization models. It allows multiple objectives being pursued simultaneously. In addition, the role of objectives and constraints could be changed during the solution process and it makes the What-if analyses to be easy to perform.

2.2 Previous Study of Embargo

Many previous scholars have been conducted to estimate the economic impact of embargo. Steven and Bryce (2015) showed the history of U.S. Cuba agricultural Trade and discussed the impact of 52 years long embargo between U.S. and Cuba on both economies. This article sets out an idea that embargoes make both sides of economies suffer from the trade barriers. Raul (2003) focused on the impact of economic sanctions on bilateral trade between U.S. as the main sender and the other three-targeted countries. The results of gravity panel models

examined the analysis of the effects of multilateral sanctions. The same paper shows that comprehensive sanctions have a large negative impact on bilateral trade while the light and moderate sanctions do not. Philip and Paul (1988) assessed the impact of the 1980 U.S. grain embargo using two types of models. The first model is spatial equilibrium model that assumes perfect substitution, while the imperfect substitutability assumption of an Armington model results in larger impacts from the embargo. In addition, the Armington model could better fit the international grain markets. John (1970) presents a comparative static model to assess the impact of relaxing the Merino export embargo on annual wool income. The results show that although the comparative static model cannot take behavior in the "real world" into consideration, the model does point out the importance of the genetic effect. The genetic effect is a critical parameter to measure the changes by the geneticists.

2.3 Previous Study of Russia's Embargo

For the previous study of the Russian embargo, since the Baltic States is considered to be the most vulnerable economic zone to the Russian embargo in the European Union, several studies have been conducted targeting this region. Kaspar (2015) assesses the effect of Russia's counter-sanctions on the economies of the Baltic States using an international Input-Output model. This paper suggested that the exports of affected goods could be amounted to 2.6% of GDP in Lithuania, 0.4% of GDP in Estonia, and 0.3% of GDP in Latvia. After taking re-exports into consideration, the overall impact of the sanctions on GDP in Baltic States is below 0.5%.

Sovala (2014) gives a summary about the detailed information of EU imposed economic sanctions and Russia's counter-sanction of food import ban. It is also summarized six assessments from different institution to analysis the direct effect and indirect effect on the production of Finland. This article concludes that the biggest direct impact by the sanction is on the dairy sector in Finland. The Russia's import ban will reduce Finland's total output in 2014 directly by around 0.1%.

Ekaterina (2014) conducted an initial assessment of Russian's restrictions on imports of agricultural and food products. This assessment paper expressed the concern that the products banned by Russia may end up being sold at very low price to the third country. This unexpected low price may severely harm the domestic producers in particular in those countries where the domestic products are already exposed to a severe competition from the imports side. The exporters to Russia may also face the greater competition from the new displaced exporters from other countries outside the EU after the Russian ban has been lifted.

The Institute Latvijas Banka (2014) also summarized the importance of trade integration between the EU27 Member States and Russia. The paper suggested that it is import to be aware that although the trade effect as importer of Russia only accounts for 0.9% of GDP in the EU, the EU countries imports trade from Russia can be amounted to 1.6%, especially the imports of energy products, including electricity, gas and water supply and air transport. Therefore, the trade dependency between the EU Member States and Russia should be estimated not only from a direct effect perspective but also from a point of indirect impacts' view. Such an aspect is addressed in this paper using an international disaggregated SAM multiplier analysis.

The most recent article published on December 2015 is from Kutlina-Dimitrova. This article assesses the economic impact of the Russian embargo on certain agricultural food products from the EU, the USA, Norway, Canada and Australia by conducting a computable general equilibrium (CGE) model. It particular focus on bilateral and total exports, production and welfare. The results suggest a similar result with my study that the impact of the ban on total

exports of the EU is limited. In addition, it also suggests that the impact on the other region such as: the USA, Norway, Canada and Australia is limited as well.

Despite many previous studies on the analysis of Russian embargo, the most of the existing works focus on the impact on the whole EU region or individual EU member country only. The contribution of this study is to construct the Input-Output tables for the most affected four EU countries and provide quantified results for both the direct and indirect effects of Russian embargo on the affected productions and value added incomes with their GDP values. Hence, this work provides a detailed study of the Russian embargo on EU countries with different level of industrialization and economic background. In addition, the study offers an opportunity to predict how the situation will develop further as well as the long-term effects of the embargo.

Chapter 3 - Methodology

In the methodology section, the multiplier analysis, particular for the Input-Output multipliers analysis is presented thoroughly. Then GTAP model is presented with the method how to map those data into an Input-Output table.

3.1 Multiplier Analysis in Economic Impact Estimates

The economic impact analysis is commonly applied to quantify the potential effects of a major change in a region's economy. Multiplier analysis, which helps with analyzing the impact of economic decisions on the output of goods and services in an economy together with the employment and personal income, is the common starting point of the economic impact analysis. Broomhall (1993) defines multiplier as a relationship between a change in an economy and the succeeding activities as a result of that change. In his framework, the initial change in the economy is referred to direct effect on production level and the indirect effect represents the cascading activities caused by the initial change.

3.2 An Input-Output Multipliers

Regional Input-Output multipliers are derived from a detailed set of industry accounts that measure the commodities produced by each industry and the use of these commodities by other industries and end consumers (Rebecca and Zoë, 2011). Therefore, an Input-Output model can provide multipliers that can be used to analyze the economy-wide effects caused by an initial change in final demand, e.g., an increase in government expenditure, a decrease in exports, or a new investment from the institution outside the economy, on a regional economy. It captures a general figure of a regional economy describing flows to and from industries and institutions. Each cell in an Input-Output table represents the payment from the account of its input (column) to the account of its output (row). It links the output of an industry with all other industries in an economy. Hence, an Input-Output table reflects a comprehensive economics structure of the studied region (See Table 5).

The Input-Output table is the subset of SAM (Social Accounting Matrics) table with only commodities and activities accounts only. The basic idea of SAM as well as Input-Output model is to use the fixed proportional technique, known as the Leontief technique, which divides a table account into endogenous and exogenous accounts. The endogenous accounts represent the sectors purchase from other sectors and the sectors sell to the other sectors, while the exogenous variable represents sectors selling to the outside world and the sectors paying to the employee and taxes.

Table 5 shows the basic structure of an Input-Output table. It describes the flow of goods and services (in value) between all industrial sectors of an economy. The amount of sector i's output required for the production of sector j's output X_{ij} is assumed to be proportional to sector j's output X_j (Sadoulet, 1995). The notations in the Table can be interpreted as follows: L represents for the Labor compensations, N denotes the other value added payments, e.g. taxes, capital or land payments, and M denotes for Imports.

Table 5 Basic Structure of An Input-Output Table

		Processing Sectors		Final Demand (Y)				Total Output (X)
		1	2					
Processing	1	x_{11}	x_{12}	C_1	I_1	G_1	E_1	X_1
Sectors	2	x_{21}	x_{22}	C_2	I_2	G_2	E_2	X_2
Payment	Value	L_1	L_2					L
Sectors	Added	N_1	N_2					N
Imports		M_1	M_2					M
Total Outlays		X_1	X_2	C	I	G	E	

Source: Gunnar and Helena, 2009

Then the production of sector 1 can be calculated by the following equations:

$$X_1 = x_{11} + x_{12} + C_1 + I_1 + G_1 + E_1 \quad (1)$$

where:

$$C_1 + I_1 + G_1 + E_1 = Y_1 \quad (2)$$

If the economy is divided into n sectors, and X_i is donated as the total output of sector *i* and Y_i is donated as the total demand for sector *i*' s product, the following equation could be derived as follows:

$$X_i = x_{i1} + x_{i2} + \cdots + x_{in} + Y_i \quad (3)$$

With n sectors, it will become a matrix as follows:

$$X_1 = x_{11} + x_{12} + \cdots + x_{1n} + Y_1$$
$$X_2 = x_{21} + x_{22} + \cdots + x_{2n} + Y_2$$
.
.
.
$$X_n = x_{n1} + x_{n2} + \cdots + x_{nn} + Y_n \quad (4)$$

In order to examine how the production will change as a response to an initial change in final demand, it is necessary to derive the technical coefficient. The technical coefficient means that how much you need the product *i* of consuming to produce one unit of product *j*. As the amount of sector *i*'s output x_{ij} is assumed to be proportional to sector *j*'s output X_j, the technical coefficient is then very intuitive as follows:

$$a_{ij} = x_{ij}/X_j \quad (5)$$

A complete set of technology coefficients is a rectangular matrix that can provide us the detailed information about the internal structure of the system. The matrix form of the equation system is: for $a_{ij}x_{ij} = X_j$,

$$X = AX + F \quad (6)$$

where: X is the denotation of matrix of X_j, A is the denotation of matrix of a_{ij}, and F is the denotation of matrix of Y_i. Then the total output can be derived from the final demand as:

$$X = (I - A)^{-1}F \quad (7)$$

where:
X: is a subset of total output and the total outlays

F: is a vector of final demand divided into household consumption (C), investment (I), government spending (G), and Export (E)
A: is the matrix of $a_{ij}'s, i, j = 1, \dots, n$ Product flow from sector *i* to sector *j*
$(I - A)^{-1}$ is the matrix of multipliers that shows the direct and indirect impact of an external injection or shock on a regional economy.

Equation (7) could be extended to the infinite series of intersect transactions:

$$X = (I + A + A^2 + A^3 + \cdots + A^{n-1})F \quad (8)$$

The first component on the right hand side of equation (8) indicates the initial change in the final demand, F. The second component indicates the intermediate demand vector, AF. The third component shows that the direct output (AF) requires for the amount of the intermediate consumption, A^2F, and so on until the process decays to zero and the sum of this series approaches to $(I - A)^{-1}$. Therefore, the formula $\Delta X = (I - A)^{-1} * \Delta Y$ shows that an initial change in final demand (ΔY) affects the total supply (ΔX) through backward linkages (demand-driven) in the form of multipliers. The $(I - A)^{-1}$ is called the Leontief inverse. The element of $(I - A)^{-1}$ measures the direct and indirect change of the output level induced by an initial change in the finial demand (F).

According to Rebecca and Zoë (2011), the impact models can measure the effect on industries in the economy in two ways. If there is an increase in one industry production, it will lead to the increase of the demand of the other industries that produce the intermediate inputs. Models that can measure demand-driven relationship as such are referred to backward-linkage model. On the contrary, if the increased production causes the increase of supply of output for the other industries, this type of supply-driven relationship models are called forward-linkage models. The model applied in this study is a demand-driven backward-linkage model.

The IO model allows the economy of a region to be divided into several well-defined sectors. Based on the level of aggregation, the study on industry sectors can be performed with different granularity. For example, in the constructed IO table of Germany, the commodities of all agricultural products can be either aggregated into one sector called agriculture products or disaggregated into more specific sectors such as: rice, wheat, vegetables, fruits, bovine cattle, raw milk, fish, and etc. The granularity of the study, in terms of the level of disaggregation perform on the studied industries, are practically limited by the granularity of the data available. The IO models used in our study are static with 57 commodities and industries in the reference year of 2011. This means that the flow between sectors reflects the economy status could be as disaggregated as 57 industrial sectors in 2011. Details of the studied models are presented in section 3.3.

3.3 GTAP Model

The disaggregated Input-Output table could be derived from the GTAP database. GTAP (Global Trade Analysis Project) captures economic activities in 57 different industries of 66 regions (see Brockmeier, 2001). The theory behind is based on a multi-regional AGE model, which consists of two sets of equations. The first part is under the principle of double entries accounting, which requires that, for each account in the SAM, total revenue equals to total expenditure. The second part is the behavioral assumptions based on the microeconomic theory, which includes utility maximization and zero profit assumptions.

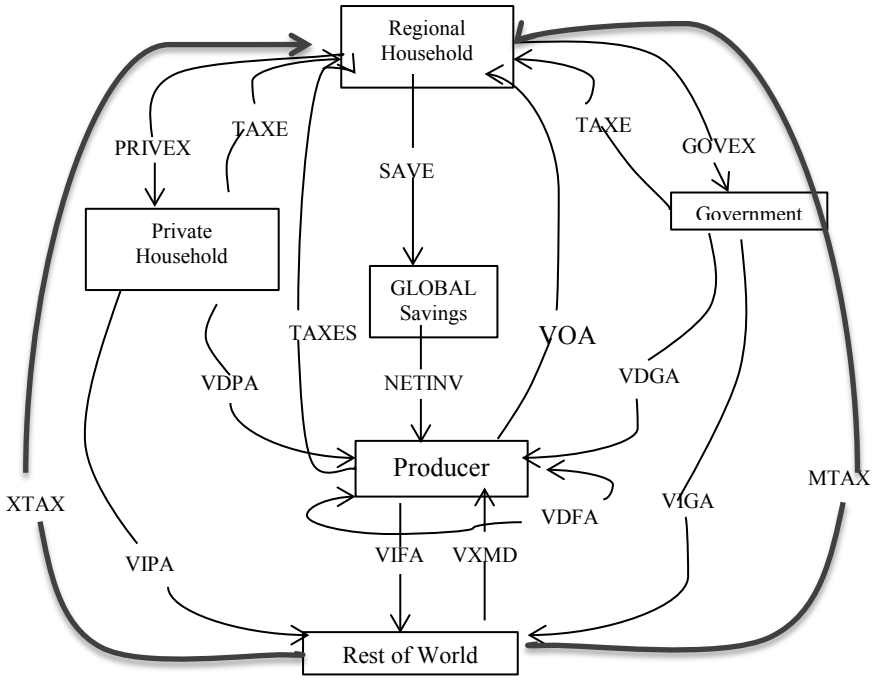
The model begins with a regional household in a closed economy without government intervention. All income generated in this closed economy is covered in this model. In a

second step, taxes and subsidies are added to this closed economy with implementation of policy instruments. Now this closed economy consists of the firms, the regional household and its three components, Private Household, savings and government, of final demand. In the third step, this closed economy is further extended to a multi-region version including a trading sector. A complete multi-region GTAP model containing the computation of subsidies and taxes implementations in the trading sector in an open economy is shown in Figure 1.

Table 6 The Notions of GTAP Variables

Notion	Meaning
V	Value
D	Domestic
I	Imports
P	Private
G	Government
F	Firms
X	Export
M	Market Price
A	Agent Price

The latest version of the GTAP database, version 9, contains data on 134 regions, 57 commodities and 8 factors including include land, technicians, clerks, service/ shop workers, officials and mangers, agricultural and unskilled, capital, and nature resources. It represents the world economy for a given reference year — 2004, 2007 and 2011. In this study, the year of 2011 is taken as the reference year since it is the closest year to the Russian Embargo. The notion used as Figure 1 showed in the GTAP database is explained in Table 6. It follows the format "V" for value; "D" or "I" for domestic or imports; "P", "G", "F" or "X" for private government, firm or export demand respectively; "M" for market prices; and "A" for agent prices (e.g. VDPA, VXM, etc.).



Source: Martina, 2001

Figure 1 A Constructed GTAP Model of Multi-Regions Open Economy

In order to construct an Input-Output table from the GTAP database, these variables need to be mapped into the IO table. Table 7 shows the way to map the transactions in the dataset into the IO table for a representative Country specifically.

Table 7 Mapping Transactions: Input-Output Table for a Representative Country

	Activity	Household Demand	Government Demand	Investment Demand	Export		Trade Taxes	Total Output
					Goods	Transport Costs		
Commodity	VDFM	VDPM	VDGM	Capital good of VDFM	VXWD	VST	VXWD-VXMD	SUM
Value added at factor cost	VFM							SUM
Sale Taxes (Imports)	VIFA-VIFM							SUM
Sale Taxes (Domestic)	VDFA-VDFM							SUM
Factor use Taxes	EVFA-VFM							SUM
Production Taxes	PRODTAX							SUM
Imports	VIFM							SUM
Total Outlays	SUM	SUM	SUM	SUM	SUM	SUM	SUM	SUM

In the study, Input- Output tables for Baltic States, Finland, Poland, and Germany, which are the most affected European regions by the Russian Embargo, are constructed from the GTAP database. These four Input-Output tables are similar to each other that contain five elements: domestic intermediate consumptions, imported goods, value added at factor cost, indirect taxes, segments of final demand including expenditures on both domestic and foreign products (export).

Chapter 4 - Data Description

The data description section is going to provide general information of economic structure for the four studied European countries by running analysis of the constructed Input-Output tables. The analysis performed here is based on the year of 2011. It is the most recent year for which the transaction table is available in GTAP dataset 9. The IO tables presented below reflect the following relationship and trade flow among various accounts.

a. Intermediate Inputs account

The intermediate inputs account, also called intermediate demand matrix, represents a payment from activities to commodities. It reflects the behavior of domestic firms buying raw material e.g., timber, ore, forage, etc., and intermediate goods to produce commodities. The receipt of this account including the following parts:

- Domestic sales of intermediate goods for producing,
- Domestic sales of final goods to households and government for consumption,
- Sales of investment goods to the capital account
- Export to the rest of the world.

The expenditure is exhausted by the purchases of intermediate goods, imports and indirect taxes. In the Input-Output table, there are 57 industries in this account and each one produces one commodity. Table 8 shows all the production and corresponding commodities in the derived IO tables. In this study, the studied industries are divided into three sectors: agriculture, manufacturing, and service.

Table 8 Sectors and Commodities Denomination

Agriculture Sector	Manufacturing Sector	Service Sector
Paddy rice	Textiles	Trade
Wheat	Wearing apparel	Transport nec
Cereal grains nec	Leather products	Water transport
Vegetables, fruit, nuts	Wood products	Air transport
Oil seeds	Paper products, publishing	Communication
Sugar cane, sugar beet	Petroleum, coal products	Financial services nec
Plant-based fibers	Chemical, rubber, plastic products	Insurance
Crops nec	Mineral products nec	Business services nec
Bovine cattle, sheep and goats, horses	Ferrous metals	Recreational and other services
Animal products nec	Metals nec	Public Administration, Defense, Education, Health
Raw milk	Metal products	
Wool, silk-worm cocoons	Motor vehicles and parts	Dwellings
Forestry	Transport equipment nec	
Fishing	Electronic equipment	
Bovine meat products	Machinery and equipment nec	
Meat products nec	Manufactures nec	
Vegetable oils and fats	Electricity	
Dairy products	Gas manufacture, distribution	
Processed rice	Water	
Sugar	Construction	
Food products nec	Coal	
Beverages and tobacco products	Oil	
	Gas	
	Minerals nec	

b. Value added account

Value added part is valued at market price, which is calculated from the sum of value factor costs and indirect taxes. Value factor costs include land, technicians, clerks, service/ shop workers, officials and mangers, agricultural and unskilled labor, capital and nature resources. In order to make a comparison of skilled labor and unskilled labor more straightforward in the

Input-Output tables derived, the factor costs are aggregated into land, capital, skilled and unskilled labor, and nature resources. The receipt of this sector comes from the sale of its service and the sales of right of usage to industries in the forms of wages, rent, and income from abroad. Furthermore, the revenue is distributed to household as labor income, to firms as non-distributed profit and to government as taxes. Indirect taxes contain sale taxes both from domestic goods, imported goods, taxes from factor users, and production taxes minus subsidies if they exist. The total amount of value added is approximately equal to the Gross Domestic Products (GDP).

c. Import account

Commodities are either supplied domestically or imported. That means productive industries purchase intermediate inputs from commodity markets, land, labor, and capital inputs from the factor markets, and imported goods from the international market. Import account here in the IO tables is taken into all the imported goods supplemented to the productive activities. Indirect sales taxes and import tariffs are paid on these commodities. The import account together with the intermediate inputs and value added accounts is taken as endogenous variables in this study.

d. Final demand account

Final demand for commodities consists of household consumption, government purchase, investment, and export demand. All of these sources of final demand exhausted all the domestic commodities. GDP is defined as the value of final goods and services produced in a given year (Rutherford and Paltsev, 1999). Theoretically, the information on GDP could be extracted from this part of the IO table. It could be calculated from the summation of private consumption, investment, government spending, and net export. This approach is represented by a usual formula for GDP:

$$GDP = C + I + G + NX \quad (9)$$

Figure 2 shows the relationship among total gross output, value added, and gross domestic product. As shown in the table, since the IO table is balanced, the value added is equal to the income earned in the production, including labor income. Total gross output is equal to the sum of intermediate inputs and value added or the sum of intermediate inputs and final demand. Thus the value added summed across all industries is equal to GDP.

<table>
<tr><td></td><td></td><td colspan="3">Industries</td><td colspan="4"></td><td></td></tr>
<tr><td></td><td></td><td>Agriculture</td><td>Manufacturing</td><td>Service</td><td>Private Consumptio</td><td>Government Purchase</td><td>Investment</td><td>Export</td><td>Total</td></tr>
<tr><td rowspan="5">Commodities</td><td>Agriculture</td><td colspan="3" rowspan="3">Intermediate Inputs</td><td colspan="4" rowspan="3">Final Demand</td><td rowspan="3">Total Gross Output</td></tr>
<tr><td>Manufacturing</td></tr>
<tr><td>Service</td></tr>
<tr><td>Value added Factor Cost</td><td colspan="3" rowspan="4">Value Added</td><td colspan="4" rowspan="4">Gross Domestic Product (GDP)</td><td></td></tr>
<tr><td>Indirect Taxes</td></tr>
<tr><td>Import</td></tr>
<tr><td>Total</td><td colspan="3">Total Gross Output</td><td></td></tr>
</table>

Figure 2 The Gross Domestic Product and Value Added in the IO table

4.1 The Economic Structures of Germany

In this part, the Germany Input-Output table is going to be presented, as well as the basic information of German economic structure. Germany is the 4th largest economy in the world after the U.S., China and Japan. It is one of the most industrialized European countries. Germany and Russia have developed a strategic trading partnership focusing on energy since 1991. Specifically, Germany is dependent on energy import from Russia and Russia relies heavily on the German investment to develop its infrastructure of energy. The disaggregated Input-Output table can provide great information of the economic structure of Germany

(Appendix A is approximate here). Appendix A gives a general picture of German Input-Output table with industries accounts disaggregated to only three sectors including: agriculture sector, manufacturing sector, and service sector. The more detailed information is going to be interpreted as follows.

a. Sectoral structure of domestic production

According to equation (9), the total GDP in Germany is 4263004.98 million dollars by adding up the total private consumption, government spending, investment and net export in 2011. The IO table also shows that agriculture products have limited contribution to the domestic private consumption compared to the other two sectors. The exported products of this sector only take up 5.18% of total exported goods in Germany.

The total value of production of Germany in 2011 is 6838509.53 million dollars with the intermediate production of 2575504.55 million dollars. Figure 3 shows the distribution of output of all 57 sectors in Germany. As the most industrialized country in the EU, German industries, e.g., machinery, precision equipment, motor vehicles and parts, and metal products, are major contributors to the German manufacturing sector. Manufacturing industries in Germany accounts for 28.78% of the country's GDP at factor cost, and employs 36.38% of the workforce.

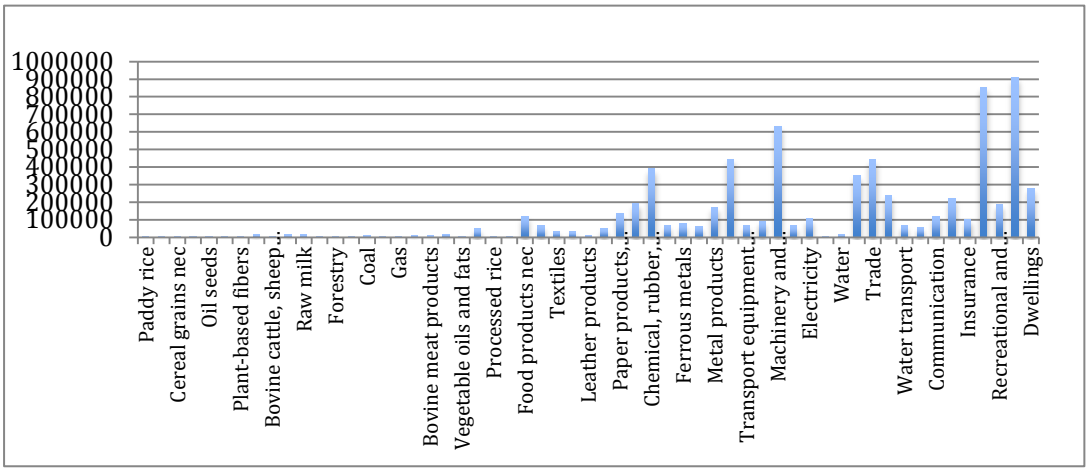


Figure 3 The Distribution of the Output by German Economic Sectors in 2011

Service sector in Germany is the foundation of Germany's economy, contributing 67.5% of the country's GDP at factor cost and employing 60.65% of the workforce. Service sector like public service, business service, trade, and dwellings contribute most of the total output of service. Germany is renowned for its highly skilled labor force. As a result, Germany ranks the third in the provision of services among exporting nations worldwide and ranks the first in skill-intensive services, e.g., technical services, IT-services and financial services. In service sector, the skilled labor takes up 65.75% of the total labor force in this sector. It also shows a healthy and well-developed industrial economy in general.

Agriculture in Germany is a small sector of the German economy. It only represents 5.03% of domestic production and contributes 3.72% of GDP at factor cost. The agriculture sector in Germany has declined in history since the 20th century and in 1989 the agriculture only amounted to 1.6 percent of GDP in West Germany. Even after the reunion of West and East Germany, the share of agriculture was only twice as high as in the west before. Despite the sector is in such a small size, it still maintains its political importance. In 2011, 394.97 million dollars is used to subsidize the export of agriculture products. The Input-Output table suggests that dairy products and meat products are the main agricultural products in 2011.

b. Sectoral contrasts in the proportion of value added

Figure 4 shows that no significant contrasts are observed between sectors, which mostly generate value added, and sectors with high intermediated demand. Agriculture sector and Manufacturing sector represent 51.13% and 58.12% of their production as value added, respectively.

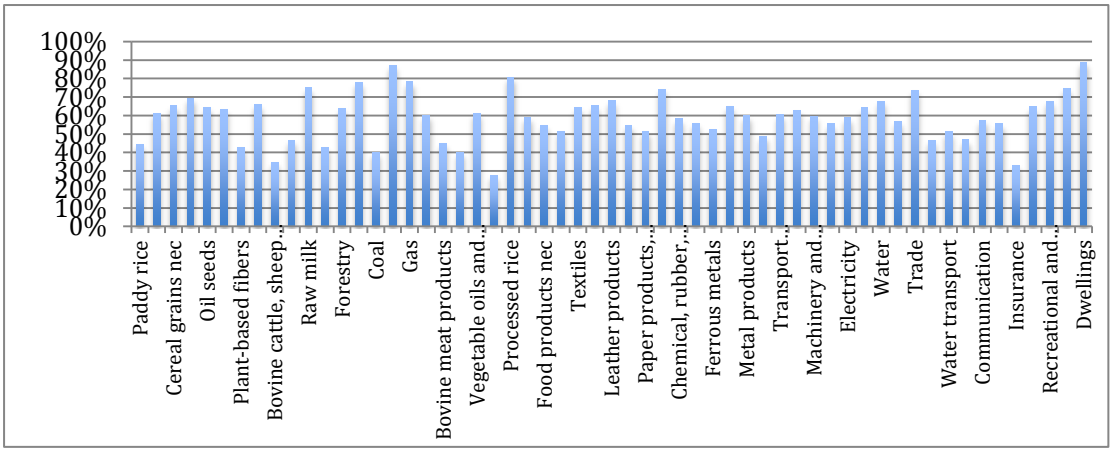


Figure 4 Value Added Proportion in the Production of Germany

Among them, the one with highest intermediate demand is agriculture sector. It uses more domestic inputs than the other two sectors. Compared to its value added share of the production, it uses 168089.08 million dollars of intermediate goods with the share of 48.87%. The service sector contributes its production with a higher proportion of 67.12% than the other two sectors as value added. It is clear that the service sector in Germany tends to have more intellectual and capital-intensive industries that producing high value added products with less intermediate demand for raw material and processing goods.

c. Import dependency and import tariff rates

The import account represents the products imported from abroad used in the domestic production. The total value of imports to the German market in 2011 is 891270.74 million dollars. Imported agriculture products in Germany only accounts for 13.06% of domestic supply and are taxed at an average rate of only 0.71%. That means that the German agriculture production is able to satisfy its domestic demand to a large extent. Therefore, German government doesn't impose high tax to protect its domestic market. For the import status of manufacturing sector, imported manufacturing products, which makes up for 22.05% of its domestic supply, contributes up to 74.77% of the total imports. It is the main part of import in Germany. However, this sector is only taxed at a low rate of 0.73%. This may imply that the manufacturing production is relative highly dependent on supplement from the foreign market compared to the other two sectors. The service sector is observed from the IO table that it has only 5.18% of import dependency and relative high tariff rate of 3.53%. This may suggest that the service industry is still a growing sector in Germany and its industries are under policy protection of the government.

d. The structure of external trade

Germany runs regular trade surpluses since 1952, primarily due to strong exports of cars and other machinery. In 2011, the trade surplus reaches 634134.89 million dollars. Manufacturing sector alone represents 82.57% of total export with 41.68% of its production for export. This indicates that the manufacturing sector is in general performing well in the world market. Compared to the manufacturing sector, the traditional agricultural export only generates 5.18% of total exports with 22.97% of its production for export. As mentioned above, since the traditional manufacturing sector serves as the main driving force of the German economic growth, the food ban from Russia side may not affect the performance of German economy

very much. There is only 5.38% of service products is exported to the foreign market. It implies that most of the industries of service sector are self sufficient to its domestic market like, public service, dwellings and so on, since Germany has a huge domestic market itself with long-term need for economic growth.

e. Macroeconomic features of Government
The investment rate in the economy is 7.18% with respect to its GDP, with manufacturing investment making up the largest part of all investment for 85.93%. Government Expenditure accounts for 15.66% of GDP with 97.64% of its consumption spent on service sector. Most of the private consumption is spent on the service products as well. In contrast, only 11.24% of household consumption is spent on agriculture products.

In general, Germany, as a well-industrialized country, has highly developed manufacturing and service sector. Agriculture production has relatively less contribution to the economy but still remains its importance. Even though the fully banned food import is imposed by Russia against Germany, the effect is expected to be very limited. Such a statement is going to be further analyzed by performing simulation studies.

4.2 The Economic Structures of Baltic States

Estonia, Latvia, and Lithuania are generally referred to as the Baltic States. This area is bounded on the west and north by the Baltic Sea, which gives the region its name. The Lativian and Lithuanian language belongs to the Baltic linguistic system, and people there are commonly known as Balts. While Estonians, who are also referred to as the Baltic Finns, are strongly influenced by the Germans. During the second half of the 20-century, large number of Russian immigrates moved to the Baltic States and this area was then "Russified" until it became independent from the Soviet Union in 1991. As a result, the economy system in the Baltic States started the transition from the planned economy to market economy. In 2004, the Baltic States joined European Union and the North Atlantic Treaty Organizations. Therefore, the economic structure of the Baltic States is characterized by their economic inheritance from the economic structure of previous Soviet Union and the integration with the free market in the European Union (Purju, 2004). In 2011, the share of the export to Russia from Baltic States takes up 9.24% of its total export. In particular, if we only count the export of banned products by Russia's embargo, the share could reach to 23.83% of the total export of corresponding products in 2011. Right now, although the manufacturing of electric motors, machine tools and radio receivers industries are considered as highly productive industries, agriculture still remains its important status within the Baltic economy. Baltic states are rich in production of potatoes, crops, dairy cattle and pigs as well as timbering and fishing. The economic structure of Baltic States extracted from Input-Output table of Baltic States (Appendix B is approximate here) is analyzed as follows:

a. Sectoral structure of domestic production
The GDP in 2011 of Baltic States is 136299.10 million dollars, among which GDP in Latvia is 28480.3 million dollars, GDP in Lithuania is 43083 million dollars and Estonia's GDP is 22542.9 million dollars. Compared to Germany, the agriculture in Baltic States has more significant role in the whole economy. It represents 14.29% of domestic production and 17.84% of GDP at factor cost. Figure 5 shows the distribution of output in all sectors in Baltic States. The dairy production and the meat production are the two major contributors in the agriculture sector. This sector employs 11.87% of total labor force and approximately 75.41% of workers are unskilled labors. Since the dairy and meat products are within the scope of the Russian embargo, the potential impact from Russia's embargo tends to be more significant on this region than Germany. In addition, the unskilled workers working in the agriculture sectors may run the risk of facing threats from Russia's embargo.

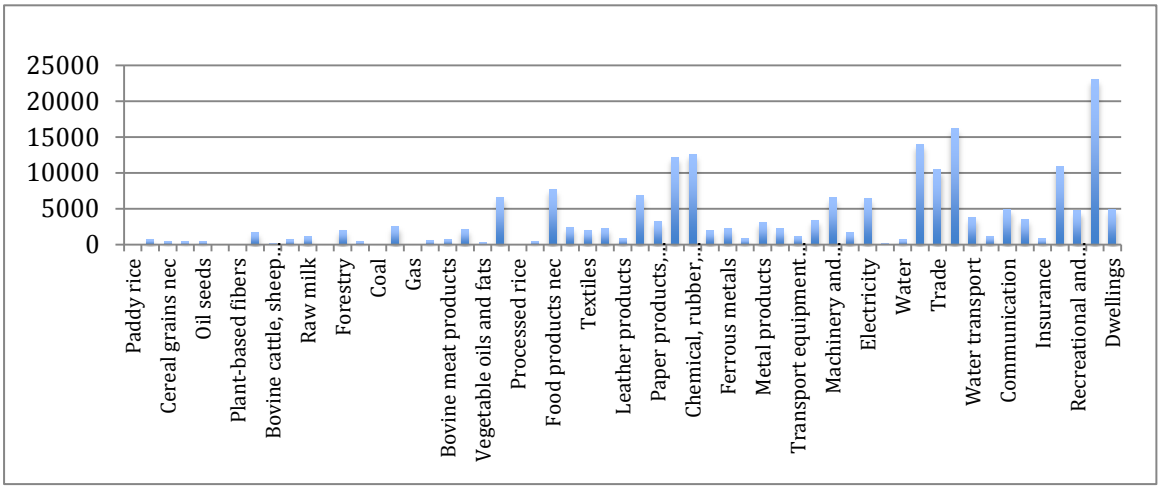


Figure 5 The Distribution of the Output by Baltic States Economic Sectors in 2011

Manufacturing sector in Baltic States is the most active sector in the whole economy. It represents 43.67% of domestic production with the monetary value of 87658.72 million dollars. The four largest exported productions in this region are chemical and plastic production, machinery and equipment production, coal, and wood production. Among these industries, machinery and equipment products are largest amount of the total export to Russia, with the monetary value of 766.96 million dollars. Manufacturing sector can account for 29.25% of the region's GDP at factor cost and absorb 34.29% of the workforce.

Service sector in this region represents the largest portion of Baltic States' economy. It contributes 42.04% of domestic production and 52.92 % of GDP at factor cost. 53.84% of labor works in this sector and 75.13% of labor is skilled labor with relative high education. The recent development in the Baltic countries' service sector shows that this region has overcome the halt of service sector that was inherited from the old Soviet system. Rapid privatization and domestic liberalization also helps the economy of Baltic becomes more open, industrialized and skill-intensive. Industries like business service and trade are the leading players in this sector. It also fits the geographical advantages of this area as an international trading hub between the eastern and western world.

b. Sectoral contrasts in the proportion of value added

In the value added account, all the studied industry sections, i.e., agriculture, manufacturing, and service, generate relative high value added compared to their intermediate demand with the shares of 67.81%, 68.67%, and 67.14% respectively (See Figure 6). With value added, further comparison can be made between labor income and profit. Labor income accounts for 52.11% of public administration, defense, education and health service sector. It is the sector with highest labor income share of all industries. Dwellings only has the labor income share of value added less than 1% but with the profit share accounts for as high as 96.86%. Such an observation indicates that it is a capital-intensive industry in the economy. The Bovine meat products is one of the high value added products in this region, it accounts for 82.03% of its production distributed in value added. The labor income share in this production accounts for as high as 51.08% of total value added. Since bovine meat products are fully banned by Russia's embargo, it is obvious that the embargo may worse off the income of the farmers who work for this production.

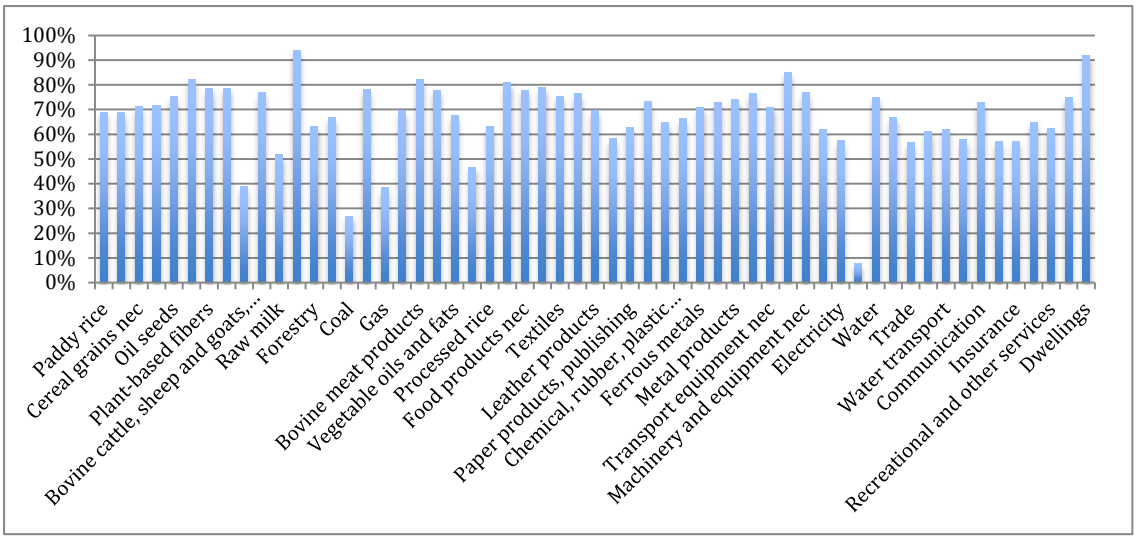


Figure 6 Value Added Proportion in the Production of Baltic States

c. Import dependency and import tariff rates

The total value of imports to the Baltic States market in 2011 is 48756.61 million dollars. Imported agriculture products accounts for 14.29% of domestic supply and are taxed at an average rate of only 1.51%. The Baltic region is not rich in natural resources. In Agriculture import, large amount of wheat, cereal and crops is imported as forage for meat production and dairy production. Imported manufacturing products, which makes up for 34.48% of its production and represents 65.58% of region's total imports. A large share of mineral and energy resources, e.g., petroleum and coal products, is imported. In addition, most of the petroleum and coal products are imported from Russia together with oil and gas products. The highest import tariff rate is imposed on service sector at an average rate of 7.15%. This sector represents 14.41% of its production supplemented by import and takes up 24.94% of total imports. The high import tariff of this sector indicates that the government is trying to protect its service production from the foreign competitors.

d. The structure of external trade

In all three Baltic countries foreign trade makes a big proportion in the structure of their GDP. The external trade represents 44.71% of GDP in 2011. This region runs trade surplus with amount of 4842.92 million dollars. Foreign trade is the main driving force for the economic growth for the Baltic States. Thank to its geographical advantages, highly qualified labor and relative low wages (Sumilo, 2006).

The traditional agriculture sector represents 14.13% of total export in the Baltic region and it takes up 26.42% of its total production. Beverage and tobacco products, dairy products and vegetables and fruits products are the largest export products of the total agriculture exports. Specially, 23.76% of dairy products, 37.66% of vegetables and fruits, and 45.35% of bovine meats are exported from the Baltic States to Russia in 2011. Unfortunately, these products are banned since 2014 when the embargo is imposed by Russia. Manufacturing sector represents the largest part of total export with a share of 69.11%. In contrast, the exported service products only contribute 16.75% of total export.

e. Macroeconomic features of Government

The investment rate in the economy is 10.02% with respect to GDP, with 81.95% of investment invests in construction industry. It indicates that the governments emphasize on the basic infrastructure in this case. Government Expenditure accounts for 13.85% of GDP with more than 99% of its consumption spent on service sector. Most of the private consumption is spent on the service products as well as the agriculture products of 49.82% and 32.08%, respectively. Only 18.1% of household consumption is spent on manufacturing

products since the most manufacturing products like machinery and equipment products are used to export due to the limited domestic demand.

In general, the economy of Baltic States, as a newly industrialized region, has a relative balanced economic structure with trading playing an important role in the whole economy. Agriculture sector still remains its importance either on the demand or on the supply market. The effect of Russia's embargo on the whole economy is worth discussing, particularly on some industries like bovine production, dairy production and vegetables and fruits productions.

4.3 The Economic Structures of Finland

The economy in Finland has been performing very well in the European Union. Its income per capita is as much as the other highly developed European economies like France, Germany or Sweden (Statistics Finland, 2015). As an economic entity, Finland is a highly industrialized country. Machinery, electronics products and construction contribute the most to its strong manufacturing industry. On the other hand, the agriculture development in Finland is limited by its geographical location, i.e., Finland lies as far north as Alaska, given its severe winter and very short growing seasons. The relative more profitable agriculture productions are productions of meat and dairy, which are highly depended on the import of low cost cattle feed. Russia is the main importer of the Finish agriculture products. There are 62.02% of the exported vegetables and fruits, 59.46% of the exported bovine cattle, and 36.95% of the exported raw milk are from Finland to Russia in 2011.

a. Sectoral structure of domestic production

The GDP of Finland in 2011 amounts to 314563.59 million dollars with the domestic production of 541350.31 million dollars (Appendix C is approximate here). Agriculture, accounts for 5.3% of domestic production and 4.77% of GDP at factor cost, is a very small part of its economy. Figure 7 shows that the largest contribution of agriculture production comes from forestry and dairy industries. Forestry plays a key role in the Finish agriculture economy. It makes Finland become one of the world's leading producers of timber. In 2011, the export of forestry related raw material amounts to 108.5 million dollars and the processed wood products exported reached to 3096.55 million dollars. This clearly shows Finland has a strong forestry industry that focuses on providing high value added products instead of just selling raw materials. Finland's government is also well known for regulating tree cutting, providing support of technical improvement, and establishing a long-term sustainable plan for this industry.

Manufacturing sector contributes 46.87% of its production. It accounts for 32.3% of GDP at factor cost. This sector employs 31.65% of labor force and 53.31% of labor force are skilled labor. 14.65% of total skilled labor works in the construction industry and 42.89% of total unskilled labor force serves in the wool and silk industry.

Similar to the manufacturing, service sector represents 47.83% of domestic production and 62.93% of GDP at factor cost. It absorbs the most manpower with a share of 64.34%, among which 67.96% of them are skilled labor. Public administration, recreational service, and business service industries attract the most skilled people in this country. Particularly for public administration sector, it employs the 30.65% of the total skilled labor power.

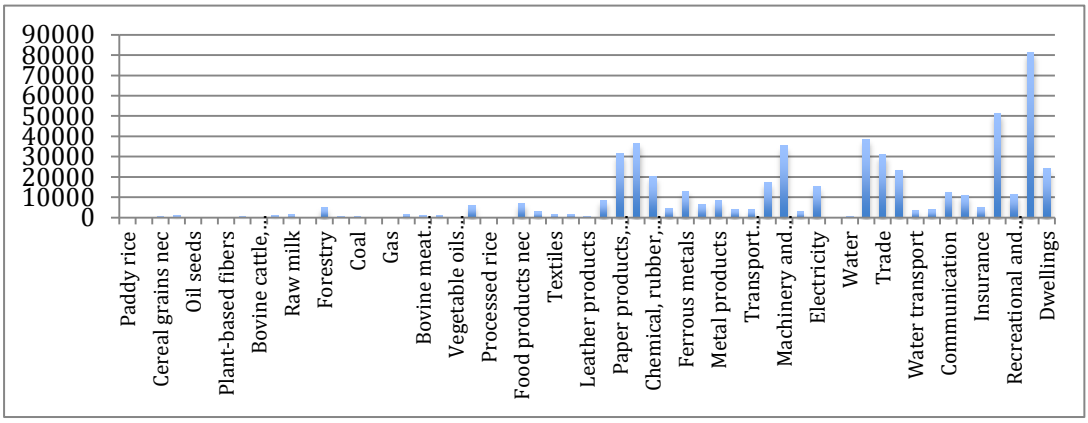


Figure 7 The Distribution of the Output by Finland Economic Sectors in 2011

b. Sectoral contrasts in the proportion of value added

In the value added account, industries like raw milk and forestry in the agriculture sector generate the most value added products with the proportion of 77.31% and 77.09%, respectively. Capital income provides the dominant share of the value added with amount of 2666.67 million dollars in forestry industry. On the other hand, labor income is the large part of the value added of raw milk at factor cost. This implies that if the Russian embargo imposes on the export of raw milk industry, the labor income of this industry runs the risk of being hurt more compared to the forestry industry. Motor vehicles and parts and water production contribute the most value added share of their production in manufacturing sector. They account for 79.02% and 79.27% distributed in value added part, respectively. In contrast, wood production industry uses the most intermediate inputs in manufacturing sector with the least value added generated (See Figure 8). Surprisingly, trading industry, the 7th highest production, only generates 22.46% of value added output. Comparing to the same industry in Germany with 70% value added, this industry in Finland seems not profitable given its lower generated capital and labor income.

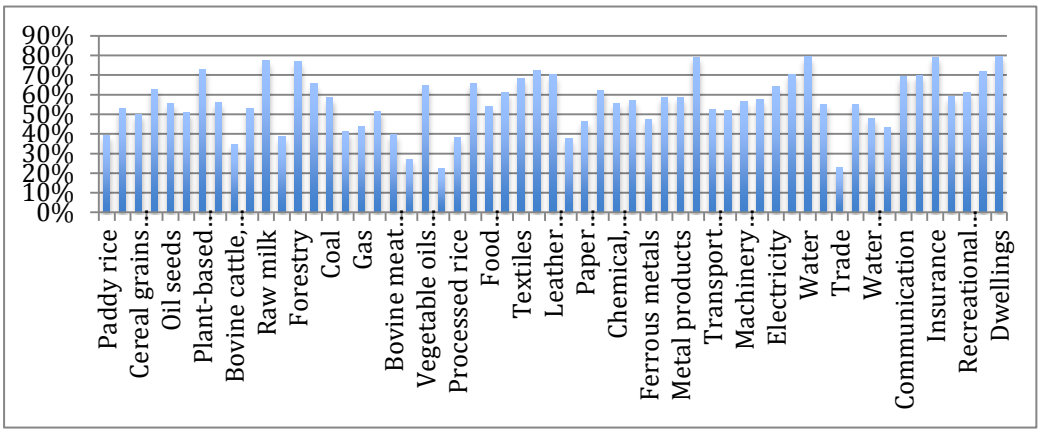


Figure 8 Value Added Proportion in the Production of Finland

c. Import dependency and import tariff rates

The total value of imports of Finland in 2011 is 76803.69 million dollars, which represents 14.19% of the total production. Imported agriculture products accounts for 11.17% of its domestic production, among which, wheat, oil seeds and vegetable and oil are highly depended on the supplements of imports. The import tariff rate is 1.23% on average. Compared to the average import tariff rate in manufacturing of 0.12%, it seems that the agriculture sector is still protected by the government policy. It is probably a relative fragile

sector in this country. Paddy rice has the highest tariff with 7.67% of its import in Finland. Imported manufacturing goods represent 21.06% of its production with the share of 69.56% of total import. Metal products and gas manufacturing products are the main parts of the import in Finland's manufacturing sector with the share of 36.26% and 36.36%, respectively. The above shows that the highly industrialized Finish economy depends on the supplements of imports of energy and raw materials in general. Imported service goods represent 7.79% of its production. Water transport service uses the most import goods in service sector with the share of 19.09% of its production. It is taxed at a rate of 1.55% on average. Similar to the other economic regions, service sector is the targets of being propped up and being protected by the nation.

d. The structure of external trade

Foreign trade makes the one third in the structure of their GDP with the share of 31.02% in 2011. Finland is highly integrated in the global economy with a trading surplus of 18034.33 million dollars. The largest trading partners are Sweden, Germany, Russia and China. The export to Russia accounts for 8.34% of the total export. The main Russian imports from Finland are machinery, chemical and plastic products, and paper products. Dairy products are the 8th largest export at total amount to Russia.

The market value of export of agriculture products (VXMD) is 2989.60 million dollars but the world value (VXWD) is 2885.19 million dollars. According to Martina (1996), if the VXMD/VXWD is greater than one, the region is applying an export subsidy to its export. This clear shows that the Finnish agriculture sector is supported by the state. The Finland Input-Output table, appendix C, shows that the export subsidy of agriculture products is 104.4 million dollars with proportion of more than 99% of total export trade tax/subsidy. 98.35 million dollars of this subsidy goes to the dairy products. This suggests that the agriculture sector in Finland is highly dependent on the support of the state policy. Manufacturing product accounts for 28.53% of its production with the share of 76.33% of total export. Machinery, paper products, chemicals and plastic product are the largest parts of export, which represent 18.07%, 14.70%, and 10.34% of total export, respectively. Government only taxes 0.094 million dollars export tax on the manufacturing sector. Additionally, 0.388 million dollars are taxed on metals products, given the fact that metal is probably considered as national strategic resources.

e. Macroeconomic features of Government

Finland is the 111th country in the world considering the investment rate of total economy inn 2008 (Statistics Finland, 2015). The investment rate in the economy is 14.56% of total GDP. Most of the investment goes to the sector of Manufacturing. Manufacturing sector accounts for 79.56% of the total investment. The distribution among the industries is slightly unbalanced, as 65.32% of the total investment went to construction business in 2011.

Government Expenditure accounts for 20.73% of GDP with more than 99% of its consumption spent on service sector. Most of the private consumption is spent on the service as well with a share of 73.22%. Only 8.85% of household consumption is spent on agriculture products.

In general, Finland economy has a highly industrialized economy, which is comparable to Germany. However, the agriculture sector in Finland is rather fragile. The government subsidies the most to the export of agriculture products based on the importance to be self-sufficiency of agriculture production for a nation. Russian embargo tends to damage the Finnish dairy product most. In particular, the labor income in the dairy business will be affected the most.

4.4 The Economic Structures of Poland

Similar to the Baltic States, Poland is another ex-communist member in the European Union. The economy of Poland started to take off after privatization and liberation taking place in 1990. Today Poland is the second largest economic entity in the Central Europe right after Germany and it has a health GDP growth rate, e.g., 3.9% in 2010 (IMF, 2011). The largest contributor of GDP of Poland is the service sector. In the Input-Output table of Poland in 2011 (Appendix D is approximate here), the service sector represents 51.67% of the GDP of Poland at factor cost.

a. Sectoral structure of domestic production

The GDP in 2011 of Poland is 636965.04 million dollars with the domestic production of 1096610.41 million dollars. Manufacturing is the largest sector and it represents 47.47% of its domestic production and 40.18% of GDP of Poland at factor cost. Construction, chemical and plastic production, machinery and equipment production, are the four pillars of the industry in Poland. Figure 9 shows that the biggest contributor to the domestic production of manufacturing sector is construction industry whose monetary value reaches 102320.12 million dollars. Manufacturing sector employs 39.30% of labor force with 39.65% skilled labor. Service sector, represents 40.90% of domestic production with up to 51.67% of GDP at factor cost, contributes the most to the GDP in Poland. The service sector also employs the most labor force with a share up to 51.59%, among which, 74.46% of the workforce is skilled labor. Public administration, education, and health service are the main contributors to the economy in Poland. These industries provide 112957.24 million dollars in domestic production and they represent 14% of GDP in this country together. The other service industries like business service and trade service also contribute 8.02% and 1.47% of GDP, respectively. Manufacturing is the second largest sector in the economy of Poland.

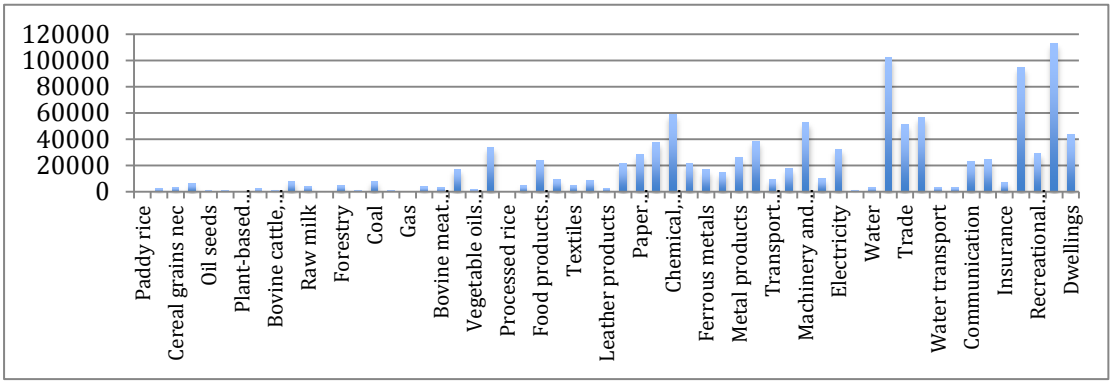


Figure 9 The Distribution of the Output by Poland Economic Sectors in 2011

Poland is rich in nature resources. Agriculture still maintains its importance in the whole economy after the industrialization of the country. Agriculture contributes 11.63% of domestic production with 8.15% of GDP at factor cost. It absorbs 9.11% of labor force in Poland and 71.24% is unskilled labor. The major agricultural products are potatoes, sugar beets, and wheat and Poland is also a net exporter of processed fruit and vegetables, meat, and dairy products. In 2011, Meat products, dairy products, and vegetable and fruits account for 12.71%, 10.16%, and 5.46% of total agriculture export, respectively. The total value of exported vegetables and fruits is 1106.79 million dollars in 2011, among which, 59.82% of processed vegetables and fruits products are exported to Russia.

b. Sectoral contrasts in the proportion of value added

Figure 10 shows that in the value added account, agricultural industries like plant-based fibers, sugar canes, and crops generate the highest value added output in the agriculture sector with the respective share of 87.42%, 69.94% and 68.31%. According to U.S. department of state (2015), Poland's agricultural land has a long history of being privately owned even under the decades of communist rule. Today most of the farms are leased to farmer tenants. As a result, the receipt from the rent of land accounts for a very large part of its value added output. The land income of plant-based fibers represents 32.52% of its total value added as well as the sugar canes and crops, whose land income contributes as high as to 24.51% and 26.27%, respectively. Industry of fruits and vegetables generates 44.81% of its production distributed to value added. 14.48% of them come from land rent and 15.22% of them are from labor income. Since fruit and vegetable exports are highly dependent on the Russian market, the imposition of food import ban could damage the relevant industries in Poland, it is likely that both the landowners and workers will lose money.

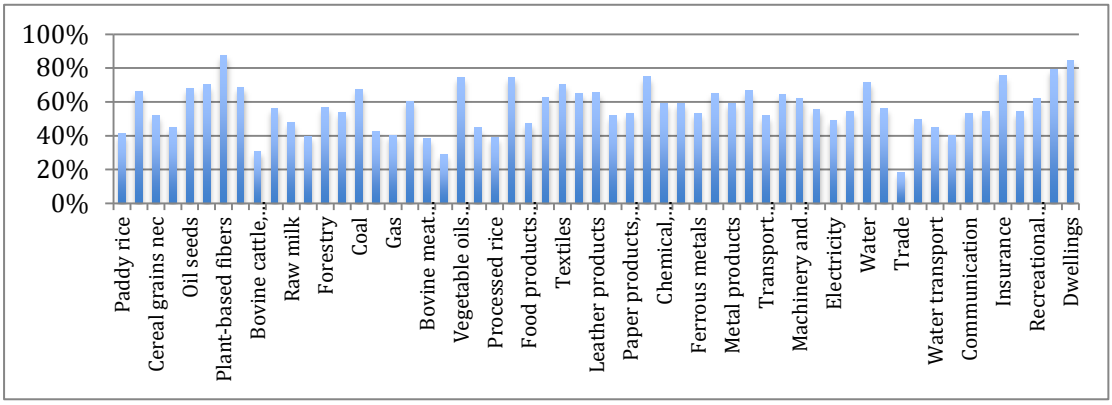


Figure 10 Value Added Proportion in the Production of Poland

Manufacturing sector generates the most value added output with a percentage of 59.54%, which is comparable to the value added share of service sector. Petroleum and coal products create the most value added output in this sector. However, the majority goes to the production tax and imports. The following analysis shows that the manufacturing industry does import the most for its domestic production. This implies that the production of this industry is highly depended on the supply from the global market.

Dwelling in service sector contributes 84.17% of its production distributed to value added but with as high as 96% from the value added of capital use. Since the capital account at the value added factor cost is going to be distributed to firms as non-distributed profit. This implies that the dwelling industry is one of the most profitable industries in the service sector in Poland. However, the labor use in this industry, which is going to be distributed as labor income, only accounts for 0.49% of total value added. Additionally, the low labor share of total value added occurs in most industries except for industries including public administration, business service, and finance service. The above analysis shows that in Poland the price of labor is cheaper compared to those more developed countries like Germany and Finland.

c. Import dependency and import tariff rates

The total value of imports of Poland in 2011 is 165452.80 million dollars, which represents 15.09% of the total production. Imported agriculture products accounts for 13.17% of its domestic production, among which, fruits and vegetables, bovine cattle and fish are the major import goods. The import tariff rate is 0.52% on average. Compared to the import tariff rate in service sector, 1.69% on average, the import tariff rate in agriculture sector is relative low. Manufacturing sector is more depended on the import of intermediate material from foreign countries. The import of this sector accounts for 21.86% of its production and its share

reaches 68.78% of total import. The petroleum and coal production imports 57.92% of its production from foreign countries. 18.67% of the imported raw material or intermediate goods to produce petroleum and coal come from Russia. In addition, oil, as the third largest import goods in Poland, which accounts for 8.45% of total imports, 92.13% of imported oil products are from Russia. This suggests that industries in the manufacturing sector, i.e., petroleum and coal industry, in Poland are relatively more dependent on Russia's export. Imported service goods in Poland represent 7.77% of its production with a tax rate of 1.55% on average. Similar to the other economic regions, service sector is the targets of being subsidized by the state.

d. The structure of external trade

Foreign trade contributes the 32.10% of total GDP of Poland and trading surplus reaches 24927.59 million dollars in 2011. The largest trading partners are Germany, France, Italy and Russia in 2011. Russia is Poland 6th largest export destination. The export to Russia accounts for 4.54% of the total export. The main products to Russia are chemical and plastic products, machinery and equipment products, and motor vehicles and parts with shares of 6.65%, 5.23%, and 4.06% of total export, respectively.

The export of fruits and vegetables from Poland to Russia accounts for the 8th largest export of total export to Russia. It represents 59.82% of its export from Poland. Similar to the other EU countries, the government of Poland subsidizes its agriculture sector in general. Particularly to the industry of fruit and vegetables, the subsidy rate reaches 97.25%. This means if the farmer can export vegetables and fruit with monetary values of 1 dollar, they can get 0.97 dollar from the state as well. Manufacturing product accounts for 28.66% of its production with the share of 78.36% of total export. Machinery, motor vehicle and parts, chemicals and plastic products are the most major export product in the manufacturing sector, which can represent 13.71%, 13.22%, and 12.63% of total export, respectively. Many industries in Poland are mainly produced for international market particularly in manufacture sector, e.g., 65.43% of motor vehicle and 59.27% of metal products are for export. Only 10.99% of total export is service products. Air transport service is the major service export in this sector.

e. Macroeconomic features of Government

The investment rate in the economy represents 13.25% of total GDP. Most of the investment goes to the sectors of manufacturing and service. Manufacturing sector accounts for 83.32% of the total investment with 62.56% of investment goes to the construction industry and 10.97% to the industry of machinery and equipment industry. Government expenditure accounts for 15.32% of GDP with more than 99% of its consumption spent on service sector. Private consumption accounts for 39.34% of GDP. Most of the private consumption goes to the manufacture industries with a share of 25.37%. 19.68% of household consumption is spent on agriculture products.

In general, Poland economy is highly integrated in the global market. Manufacturing sector contributes the most to its economy. Service sector generates the most GDP per capita. Agriculture sector still remains its importance to the whole domestic production with the export of food products as the largest part of export to Russia. Fruit and vegetables are the second largest agriculture product export to Russia. It is within the scope of the food ban of Russia. Since the land rent in this industry shares a large share of its value added income, the landowners are facing the threat from Russian embargo. In addition, the embargo tends to weaken the production of the vegetable and fruits in Poland as well due to its large share of export to its domestic production.

Chapter 5 - Simulation and Results

A full embargo means completely banning import of certain products from the target countries. In this policy experiment, the external shock of a 100% cutting off the export of banned food to Russia is simulated for the four studied EU regions. Specially, 57 endogenous production accounts from the regions of interest are included in the simulation in order to quantify the direct and indirect impact on the total production of each economy as well as the impact on GDP of economies. In the simulation, the 100% shock is applied to the target export products, shown in Table 9, to Russia.

Table 9 Corresponding Banned Food in the Simulation

Vegetables, fruit, nuts	Bovine meat products	Animal products	Vegetable oils and fats
Bovine cattle, sheep and goats, horses	Meat products	Raw milk	Dairy products
	Fishing		

When the export of aforementioned banned foods are removed from the total export, the following effects on output could be observed in Figure 11 based Upon the IO multipliers, $(I - A)^{-1}$.

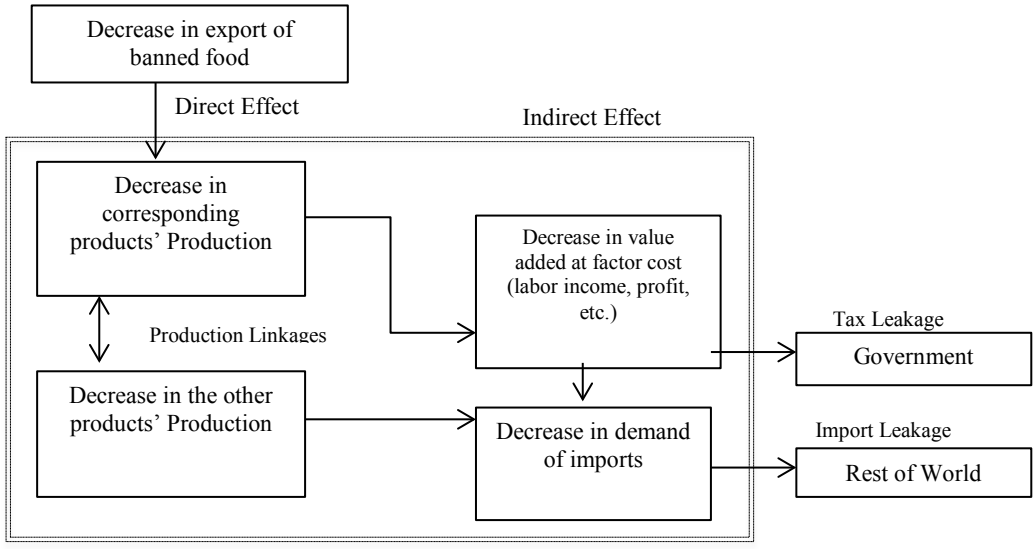


Figure 11 Flow of Change in the Multiplier Process

An initial decrease in parts of the export of the studied region is going to reduce the production of corresponding products directly, which is called direct effect from the external shock. Then the decreased production is going to bring down the demand of intermediate goods from other sectors, e.g. reduction in animal meat production will decrease the demand of forage and barley. This is referred to as indirect effect. The indirect effect may, in turn, interact to the directly affected production as another round of feedback loop until the effects is vanished. Then the influenced production link may further decrease the factor use e.g., labor, land, and capital, together with the demand for imports. These decreases tend to further affect to the income of taxes to the government and the income from the import to the rest of the world.

5.1 Policy Simulation of Germany

Russia is the 12th largest export destination of Germany in 2011. The export from Germany to Russia accounts for 3.3% of total export. Specifically, machinery and equipment are the biggest part of total export to Russia with a share of 31.89%. Motor vehicle and parts takes up 17.08%. Agriculture products such as: bovine meat, dairy products, and vegetable and fruits represent 11.06%, 5.85%, and 3.32% of their total exports, respectively. Table 10 shows the direct effects on the corresponding commodities of an external shock from Russian Embargo.

Table 10 Direct Effects on Output of Germany (million dollars)

Item	Total output	Shock	Change in output	New Output	% Change
Bovine meat products	7559.04	-312.60	-314.92	7244.12	-4.17%
Bovine cattle, sheep and goats, horses	4645.43	-32.65	-160.21	4485.22	-3.45%
Meat products	18020.81	-425.02	-426.17	17594.64	-2.36%
Animal products	14033.62	-56.34	-271.53	13762.09	-1.93%
Vegetable oils and fats	5507.44	-92.84	-95.06	5412.38	-1.73%
Vegetables, fruit, nuts	5114.27	-82.55	-83.65	5030.63	-1.64%
Dairy products	48763.41	-373.91	-528.70	48234.71	-1.08%
Raw milk	14457.83	-0.16	-126.62	14331.21	-0.88%
Fishing	1167.61	-0.31	-0.55	1167.06	-0.05%

The items listed in Table 10 are the banned products, ranked according to their percentage of change in the Russia's embargo. Column 2 in Table 10 shows the original total output before the external shock. Column 3 is the export of banned food from Germany to Russia. Before the embargo, those values are the amount of exported food to Russia. They are removed from the total value of export in this simulation, given the Russia's embargo. After applying the simulation of the embargo, the direct impact on the output of banned food products is the deduction of total output in origin. The scope of the deduction is shown in the last column. The biggest decline after the shock is the bovine products, including bovine cattle and bovine meats products, with reduction of 3.45% and 4.17%, respectively. The reduction in bovine production further affects the intermediate demand of crops and business services the most with the multipliers of 0.034 and 0.638 in the matrix of $(I - A)^{-1}$. As a result, the indirect effect of crops and business service sectors decrease by 0.08% and 0.04% respectively. The complete results of simulation of Germany are presented in Appendix E. In general, both the direct effect and indirect effect on the German production level are not very significant. The most affected indirect productions are the oil seeds, cereal, and wheat with the magnitude of output decreasing less than 1%. Thus, the impact on the production of Germany of Russia's embargo actually is very limited. Figure 12 presents the simulation results in a more visual way. The yellow bars represent the direct affected industries while the blue bars stand for the indirect affected industries.

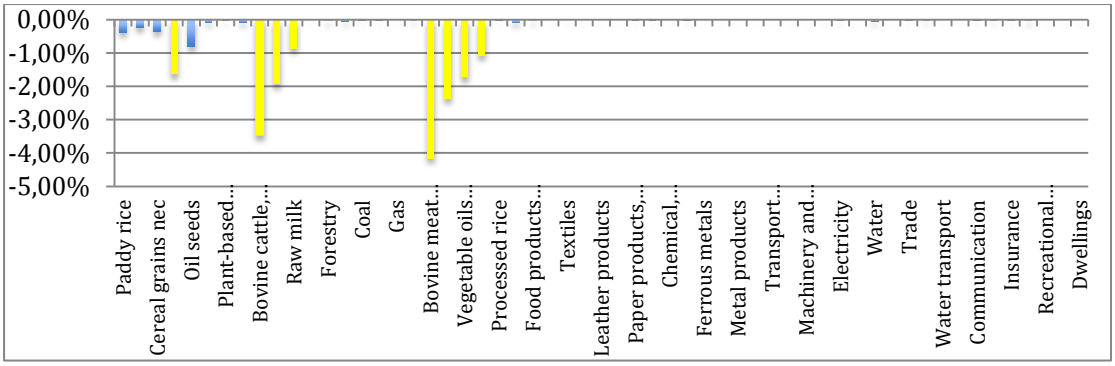


Figure 12 Simulation Effects on the Production Level

Then we move to the value added account. The production reduction further leads to the decrease of using factors like labor, capital, land, and nature resources and the income of indirect taxes from factor use, domestic sales and import tariff. Taking the most affected production of bovine meat as an example (See Table 11), the decreased new output generates 3249.83 million dollars instead of the original value added, which is 3391.11 million dollars.

Table 11 Indirect Effects on Value Added of Germany (million dollars)

Item	Old Value Added	New Output	Value Added Share	Absolute Change	New VA
Meat products	7232.72	17594.64	0.40	-171.04	7061.68
Dairy products	13563.11	48234.71	0.28	-147.05	13416.06
Bovine meat products	3391.11	7244.12	0.45	-141.28	3249.83
Animal products	6534.95	13762.09	0.47	-126.44	6408.50
Raw milk	10851.13	14331.21	0.75	-95.04	10756.10
Vegetable oils and fats	3378.87	5412.38	0.61	-58.32	3320.55
Vegetables, fruit, nuts	3546.80	5030.63	0.69	-58.01	3488.79
Bovine cattle, sheep and goats, horses	1613.97	4485.22	0.35	-55.66	1558.31
Fishing	913.02	1167.06	0.78	-0.43	912.59

It causes the labor income to decrease 165.20 million dollars, which can be calculated by multiplying the labor share of value added and the total amount of value added generated by the new output in the production of Bovine meats. Since the labor use at factor cost is going to be distributed to the household income account, in a larger scale table like social accounting matrix table, the decreased labor use can lead to the loss of labor income. This means that the workers in this production are going to lose their income of 165.20 million dollars due to the successive impacts from the Russian embargo. The similar observation could be found in the business service sector (See Figure 13), the value added income of this sector drops the most of all industries with the absolute value of -206.60 million dollars. It is because in the matrix of Input-Output multipliers of those targeted products, business sector has higher weights as intermediated inputs than the other sectors. Particular for the production of bovine cattle, the multiplier is 0.63827. Thus, the business sector is most affected by the change in the production of industries like bovine cattle, bovine meats, and animal products. That means these agricultural industries need relative more business service in their process of productions in Germany. In the value added income of business service sector, capital income and labor income is the most affected income accounts. They will lose 107.08 million dollars and 54.65 million dollars, respectively. Figure 13 graphically shows the effects on the value added income account.

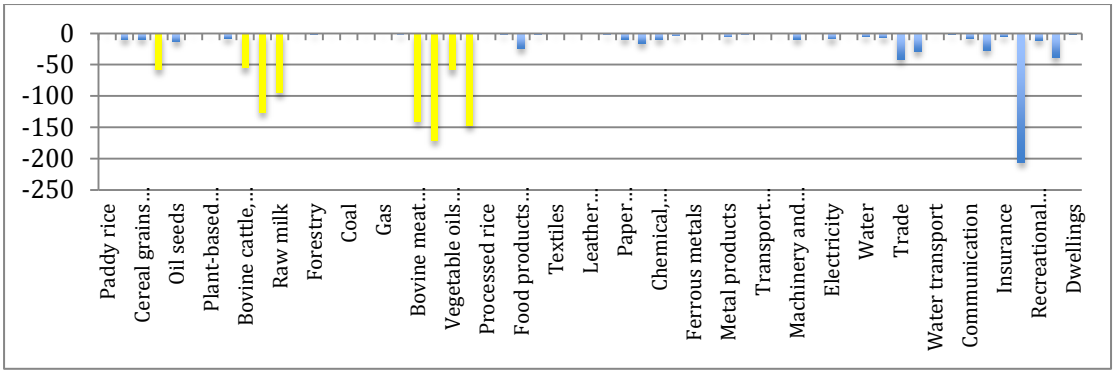


Figure 13 Simulation Effects on the Value Added Income

Since the GDP value could be obtained from the summation of all value added. Before the external shock, the original GDP of Germany is 4263004.98 million dollars. According to the simulation results, the Russia's embargo will decrease the GDP to the estimated amount of 4261628.45 million dollars. Therefore, the GDP of Germany is going to drop by 0.03%. This confirms the above statement that the impact of Russian embargo is very limited, given the small percentage of agriculture production in the German economy.

5.2 Policy Simulation of Baltic States

The total amount of export in Baltic States is 53599.53 million dollars and it contributes 44.71% of GDP of this region. The largest export destinations are Russia, Germany, Sweden and Finland. The total amount of export to Russia is 4951.76 million dollars, which accounts for 9.24% of total export. Machinery and equipment, chemical and plastic products, transport service, beverages and tobacco products, and dairy products are the top five largest exported products to Russia, which account for 16.38%, 7.98%, 93.03%, 27.29%, and 23.76%, respectively, to the total exports. Among them, the dairy export is directly affected by the embargo, which means 23.76% of its export needs to find new market and consumers.

Table 12 shows the direct effect on the production of banned products in the Baltic States after the external shock brought by the embargo.

Table 12 Direct Effects on Output of Baltic States (million dollars)

Item	Total output	Shock	Change in output	New Output	% Change
Vegetables, fruit, nuts	417.32	-117.76	-118.97	298.35	-28.51%
Animal products	679.53	-91.87	-94.94	584.59	-13.97%
Bovine meat products	756.56	-89.95	-90.43	666.14	-11.95%
Dairy products	6625.38	-271.54	-341.41	6283.98	-5.15%
Bovine cattle, sheep and goats, horses	196.39	-1.71	-9.47	186.92	-4.82%
Raw milk	1103.22	-0.10	-43.27	1059.95	-3.92%
Fishing	404.14	-1.32	-7.13	397.01	-1.76%
Meat products	2167.12	-24.92	-25.18	2141.94	-1.16%
Vegetable oils and fats	243.19	-1.17	-1.44	241.75	-0.59%

Column 2 in Table 12 is the original output of the targeted products before the embargo. Column 3 shows the export of banned food from Baltic States to Russia. In addition to the dairy products, 37.66% of exported vegetable and fruits, 34.79% of exported animal products, 45.35% of exported bovine meats, 15.83% of exported raw milk from Baltic States are removed from the total export. Those shocks on the export, if the top three affected industries

are counted, directly lead to a loss of monetary value 341.41 million dollars in dairy production, 118.97 million dollars loss in vegetables and fruits production, and 94.94 million dollars loss in animal products production, respectively. When taking the relative value of changes into consideration, the external shock from the food ban is going to decrease the production of vegetables and fruits by 28.51%, the production of animal products by 13.97%, and the production of bovine meats by 11.95%. The simulation results are ranked according to their percentage of change. Appendix F shows the simulation results of all 57 commodities. The most affected indirect productions are paddy rice and cereal and grains with reduction of 1.77% and 1.41%, respectively. According to the matrix of Input-Output multipliers of Baltic States, $(I - A)^{-1}$, it is clear that both the paddy rice and cereal productions dominates the indirect Input-Output multiplier effect corresponding to the targeted food product. Taking raw milk as an example, the multiplier of raw milk itself is 1.01146. It means that one unit change in the raw milk demand will cause 1.01146 units of raw milk production output change. Furthermore, the multiplier of cereal for raw milk is 0.07470. Therefore, each unit change in raw milk demand will further lead to a change on the output of cereal by 0.0747 units. Since the external shock of the embargo mainly affect on the output of livestock productions most, it makes sense that the intermediate demand for feeding cattle like cereal and crops is declined the most. Figure 14 presents the simulation results in a more visual way.

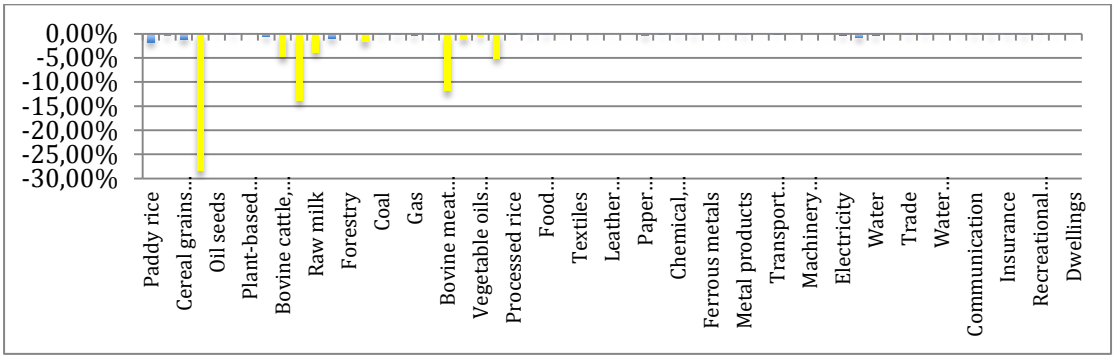


Figure 14 Simulation Effects on the Production Level

Considering the indirect impact on value added account, Table 13 shows that the indirect effects on value added output of corresponding banned products. The more effects on more products could be found in the appendix F.

Table 13 Indirect Effects on Value Added of Baltic States

Item	Old Value Added	New Output	Value Added Share	Absolute Change	New VA
Dairy products	3083.22	6283.98	46.54%	-158.88	2924.34
Vegetables, fruit, nuts	299.03	298.35	71.65%	-85.25	213.78
Bovine meat products	620.64	666.14	82.03%	-74.18	546.46
Animal products	523.35	584.59	77.02%	-73.12	450.23
Raw milk	570.56	1059.95	51.72%	-22.38	548.19
Meat products	1687.40	2141.94	77.86%	-19.60	1667.79
Fishing	269.88	397.01	66.78%	-4.76	265.12
Bovine cattle, sheep and goats, horses	76.72	186.92	39.06%	-3.70	73.02
Vegetable oils and fats	164.19	241.75	67.52%	-0.97	163.22

The decreased production could forward its negative effects to the value added account as well. Column 5 in Table 13 shows the absolute change caused by the embargo on the value added output. Taking the most affect value added account of dairy products as an example, the shares of capital and labor in the value added are 39.1% and 14.4%, respectively. Thus,

the new capital income and labor income could be derived from the multiplication of the new amount of value added of dairy products and the share of capital or labor in the value added account. They are: 1143.40 million dollars and 421.17 million dollars. Compared to the old capital income and labor income, the capital income will lose 62.12 million dollars and the labor income will lose 22.88 million dollars after the shock of Russia's embargo. The unskilled labor is going to lose more than the skilled labor since it shares larger proportion in the value added account. Figure 15 graphically shows the effects on the value added income account.

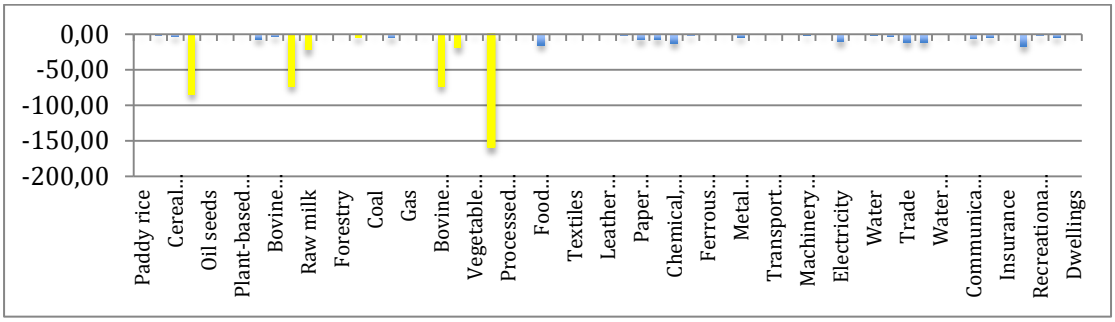


Figure 15 Simulation Effects on the Value Added Income

The new GDP in the Baltic States is derived from the summation of all new value added output in the simulation. The total amount reaches 135698.75 million dollars. Compared to the original GDP with monetary value of 136299.10 million dollars in 2011, the GDP in Baltic States is going to lose 600.35 million dollars, which represents 0.44% of the original GDP.

In general, the impact of Russian embargo is moderate for the whole economy in Baltic States, i.e., the GDP in this region only loss less than one percent. However, from the standpoint of individual industry like: vegetable and fruits production, dairy production, and animal production, the embargo does hurt their outputs of productions, labor and capital income of value added. This is especially true for the vegetable and fruits production. It severely causes its production dropped by 28.51%. Since the landowner and unskilled labor share a large proportion in the value added output, the production output reduction may further hurt the income of both parties. The Baltic States is the most influenced region among the studied four regions.

5.3 Policy Simulation of Finland

Russia is the third largest export destination of Finland. It represents 8.34% of the country's total export. The largest parts of exported products from Finland to Russia are products from its manufacturing sector. Machinery and equipment, chemical and plastic products, and paper products are the top three largest exported products to Russia. These products account for 10.13%, 11.06%, and 5.85% of their total exports, respectively. From a percentage standpoint, the dairy product export to Russia has the largest share of its total export. In 2011, 46.25% of the exported dairy products from Finland are to Russia. In the following simulation, all targeted products by Russia's embargo are excluded from the total export of Finland. Table 14 shows the direct effect on the production of banned products in Finland after the external shock from the embargo.

Table 14 Direct Effects on Output of Finland

Item	Total output	Shock	Change in output	New Output	% Change
Dairy products	5835.90	-301.01	-453.60	5382.30	-7.77%
Raw milk	1398.63	-0.03	-99.03	1299.60	-7.08%
Animal products	1126.17	-56.28	-65.50	1060.68	-5.82%
Bovine cattle, sheep and goats, horses	262.42	-4.02	-6.48	255.94	-2.47%
Fishing	379.17	-4.94	-8.16	371.01	-2.15%
Meat products	1167.39	-24.15	-24.71	1142.68	-2.12%
Vegetables, fruit, nuts	989.46	-18.88	-20.59	968.86	-2.08%
Bovine meat products	987.84	-10.24	-10.65	977.20	-1.08%
Vegetable oils and fats	204.27	-0.70	-1.30	202.97	-0.63%

Column 2 in Table 14 is the original output level of the targeted products in Finland. Column 3 shows the original export from Finland to Russia before the embargo, which is removed in this simulation as an external shock on Finland's total export. The dairy products are the most affected industry in this embargo. According to the simulation study, the production of dairy products drops 453.60 million dollars. This accounts for 7.77% of its original output level. Another dairy related industry, raw milk suffers from a 7.08% reduction. Considering the monetary value, the embargo will cause 690.02 million dollars' loss in total, only for the direct affected production level. Appendix G shows the detailed simulation results including impacts on the output level of the other 48 indirect productions of the embargo. Among these indirect productions, the most affected productions are paddy rice, wheat, cereal and grains, and crops, which account for the decrease scopes of 2.47%, 0.66%, 1.84%, and 1.08%, respectively. The total indirect productions loss reaches 305.8 million dollars in a monetary value. As discussed earlier, since the crops growing production itself is vulnerable in Finland, this industry is sensitive to the change in the intermediate demand of its domestic livestock market. Figure 16 presents the simulation results of direct effect and indirect effect on production level graphically.

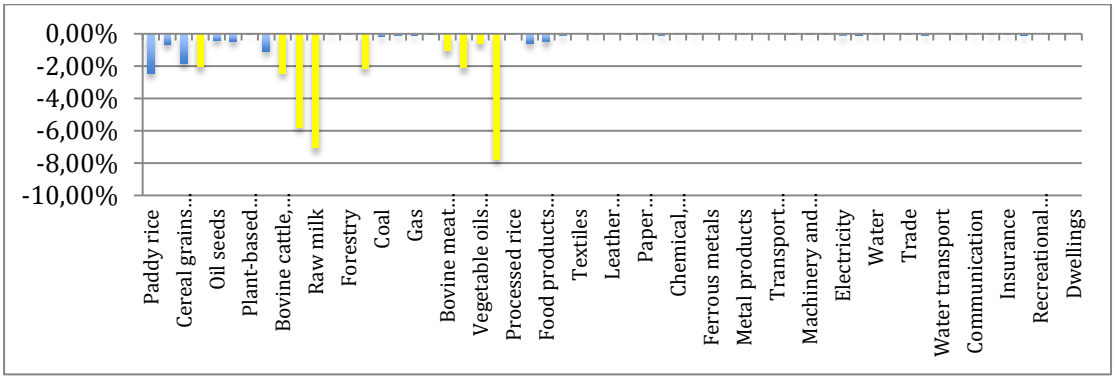


Figure 16 Simulation Effects on the Production Level

From the matrix of Input-Output multipliers, $(I - A)^{-1}$, the multiplier with highest weight of all the banned products is dairy product, which is 1.49284. It means that among all the targeted products, dairy production is the one causes the most negative influence on the Finland's economy. Among the intermediate inputs to diary production, raw milk has the largest weight with a multiplier of 0.31615, as it is the most basic material to any diary product. Cereal and grain production, with a multiplier of 0.01127, and crop production, with a multiplier of 0.01127, are also important ingredient to diary product, as they are the main food supply for cattle.

Next, the discussion moves to value added accounts, which are affected by the forwarded impacts from the production linkage. The indirect effects on value added output of targeted products in Finland are shown in Table 15.

Table 15 Indirect Effects on Value Added of Finland

Item	Old Value Added	New Output	Value Added Share	Absolute Change	New VA
Dairy products	1310.67	5382.30	22.46%	-101.87	1208.80
Raw milk	1081.37	1299.60	77.32%	-76.56	1004.80
Animal products	598.17	1060.68	53.12%	-34.79	563.38
Vegetables, fruit, nuts	619.64	968.86	62.62%	-12.90	606.74
Meat products	317.59	1142.68	27.20%	-6.72	310.86
Fishing	248.44	371.01	65.52%	-5.35	243.10
Bovine meat products	390.45	977.20	39.53%	-4.21	386.24
Bovine cattle, sheep and goats, horses	90.61	255.94	34.53%	-2.24	88.37
Vegetable oils and fats	132.63	202.97	64.93%	-0.84	131.79

The complete simulation results on the value added products is presented in Appendix G. Column 5 in Table 15 shows the absolute change caused by the embargo on the value added output. The most affected value added account is dairy products, which is going to decrease 101.87 million dollars. Along with the dairy products, raw milk will suffer a 76.56 million dollars' loss on its value added account. Figure 17 shows the simulation effects on the value added income account in a more visual way.

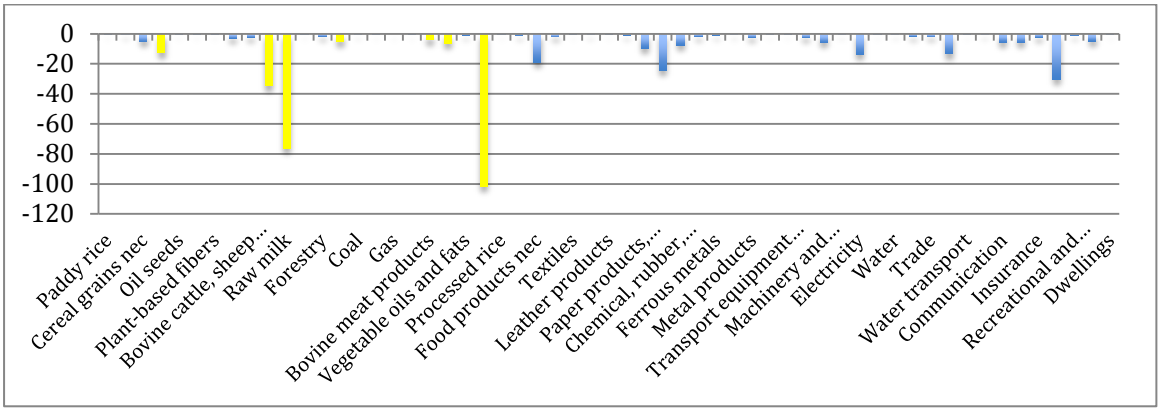


Figure 17 Simulation Effects on the Value Added Income

In the industry of dairy products, the shares of capital and labor in the value added account are 21.30% and 27.52%, respectively. The loss of 101.87 million value added will be transferred to loss on capital income of 21.70 million dollars together loss on labor income of 28.03 million dollars. The reason is that all capital is going to be distributed as non-distributed profit to firms and all labor receipt is going to be distributed as household income in a larger scale of Input-Output table. The unskilled labor tends to suffer more comparing to the skilled labor, as the former has a higher share in the value added output. The same conclusion holds for the other industries including raw milk, animal products and so on. In the economic structure of Finland, as discussed earlier, the state subsidies dairy products in Finland. The diary product export decline implies that a saving on the subsidies from the state. Given the subsidy rate of 15.11% and the diary product export decline of 301.01 million dollars, the embargo can lead to a saving of 45.49 million dollars on state subsidy in Finland.

The GDP value could be derived from the summation of all value added. Before the introduction of external shock, the original GDP of Finland is 314563.59 million dollars. After the Russia's embargo is imposed, the simulation suggests that the GDP of Finland reduces to 314143.34 million dollars with a percentage reduction of 0.13%. The reduction in GDP is actually limited to the economy of Finland. It implies that the impact of Russia's embargo may not have significant impact on the GDP of Finland. However, it does have some impact on individual industries, e.g. dairy production and raw milk production. The impact will be further propagated to affect the labor and capital income in value added outputs.

5.4 Policy Simulation of Poland

The total amount of Poland's export is 190380.39 million dollars. The largest trading partners are Germany, United Kingdom, France, Czech Republic, and Russia. As the 5th largest export destination of Poland, trading with Russia has a share of 4.54% of the country's total export. The major products exported to Russia are chemical and plastic products, machinery and equipment products, and motor vehicles and parts, which account for 6.65%, 5.23%, and 4.06% of the corresponding total exports. Among the targeted products of the Russia embargo, vegetables and fruits export has the highest monetary value, which reaches 512.20 million dollars. The vegetable and fruit export accounts for 59.82% of its total export. Table 16 shows the direct effect on the production of affected products after the external shock from the embargo in Poland.

Table 16 Direct Effects on Output of Poland

Item	Total output	Shock	Change in output	New Output	% Change
Vegetables, fruit, nuts	6021.34	-344.05	-512.20	5509.13	-8.51%
Bovine meat products	3256.42	-54.93	-55.74	3200.69	-1.71%
Bovine cattle, sheep and goats, horses	1087.88	-3.31	-18.49	1069.38	-1.70%
Animal products	7469.45	-18.21	-29.75	7439.70	-0.40%
Dairy products	33604.84	-85.07	-106.62	33498.21	-0.32%
Raw milk	4185.37	-0.20	-11.11	4174.25	-0.27%
Fishing	704.92	-0.08	-1.32	703.60	-0.19%
Meat products	17007.44	-31.10	-32.56	16974.88	-0.19%
Vegetable oils and fats	1910.48	-0.54	-1.83	1908.65	-0.10%

The items listed in Table 16 are the targeted products by the Russian embargo. Column 2 shows the original total output level before the external shock. Column 3 is the export to Russia but cut off by the embargo. Column 4 represents the simulation results of changes in the corresponding output. The most affected industry, according to Table 16, is the production of vegetables and fruits. The absolute value of loss in this industry is 512.20 million dollars, which accounts for 8.51% decline of the total output. After the vegetables and fruits production, the second most affected industry is the dairy production. The embargo leads to a direct loss of 106.62 million dollars in the diary production industry. The total amount of the loss due to the direct effect on productions reaches 769.62 million dollars.

The impact of production declines the productions of other industries that provide intermediate inputs to the affected productions. For example, the decline on meat production is going to reduce the production of cereal and grains given the declining demand. Similar to the other studied regions, the most affected indirect productions are paddy rice, wheat, cereal and grains, and crops. Specially, their percentages of reduction are 0.65%, 0.14%, 0.29%, and 0.19%, respectively. The detailed results from simulation are concluded in appendix H. The indirect effects are not very significant on the production level, since the declines of most

productions are less than 1%. Figure 18 presents the simulation results of direct effect and indirect effect on production level graphically.

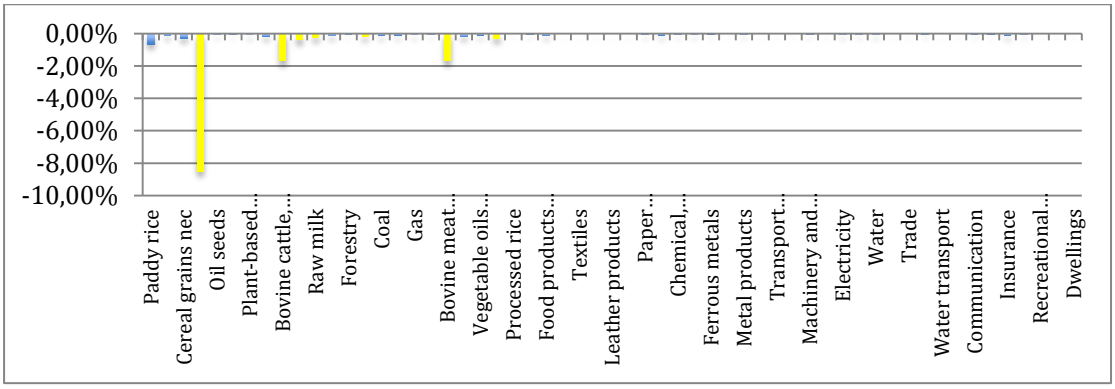


Figure 18 Simulation Results on the Production Level

Next, the discussion moves to value added accounts. Table 17 shows the indirect effects on value added output of the targeted products in Poland.

Table 17 Indirect Effects on Value Added of Poland

Item	Old Value Added	New Output	Value Added Share	Absolute Change	New VA
Vegetables, fruit, nuts	2698.27	5509.13	44.81%	-229.53	2468.74
Dairy products	14968.78	33498.21	44.54%	-47.49	14921.28
Bovine meat products	1246.18	3200.69	38.27%	-21.33	1224.85
Animal products	4190.64	7439.70	56.10%	-16.69	4173.95
Meat products	4922.81	16974.88	28.95%	-9.43	4913.38
Raw milk	1999.76	4174.25	47.78%	-5.31	1994.44
Bovine cattle, sheep and goats, horses	335.61	1069.38	30.85%	-5.71	329.90
Vegetable oils and fats	1421.96	1908.65	74.43%	-1.36	1420.60
Fishing	378.94	703.60	53.76%	-0.71	378.23

Column 3 and column 4 in table 17 show the new output level of the banned products and the shares of value added output corresponding to their productions. The products of column 3 and column 4 are new value added output of corresponding productions. The absolute change shows the difference between value added amount before the embargo and the new value added amount afterwards. Vegetables and fruits production suffers the largest loss of value added with a monetary value of 229.53 million dollars. Specifically, the shares of land and labor in its value added account represent 14.48% and 15.22%, respectively. They have the largest share of value added account. The simulation suggests that the Russian embargo can result in a monetary loss of 33.24 million dollars for landowners and 34.94 million dollars for workers. Furthermore, as there is more skilled labor than unskilled labor in this industry, they suffer more from the embargo. Figure 19 shows the simulation effects on the value added income account in a more visual way.

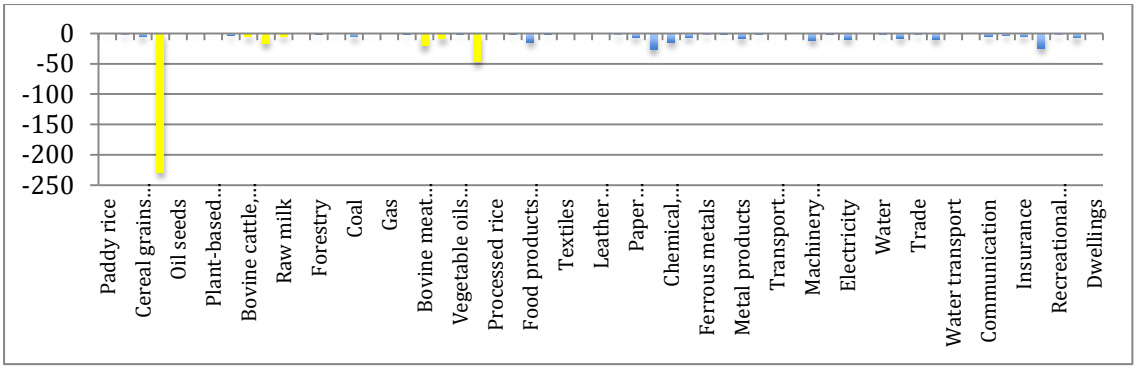


Figure 19 Simulation Effects on the Value Added Income

The GDP value derived from the old production in Poland amounts to 636965.04 million dollars. After the external shock from the declined export, the summation of total value added derived from the new production reduces to 636427.56 million dollars. Thus, the loss of GDP from the simulation results in Poland is 537.49 million, which is 0.08% of total GDP.

Generally speaking, the impact of Russia embargo only slightly affects certain industries in Poland including: vegetables and fruits and dairy productions. The impact on the whole economy of Poland is minor since the effect on GDP is as less as 0.08%. The vegetables and fruits production is the most affected industry in Poland. Since most of land is private owned in Poland, the landowners may suffer the loss of land income from the embargo together with the skilled workers in this industry.

Chapter 6 - Discussion and Conclusion

This study investigates the impact of the Russia's embargo on the most affected EU regions using Input-Output multiplier analysis techniques. The studied European regions include the economies of Germany, Baltic States, Finland and Poland.

Germany and Finland are highly industrialized with a small part of agriculture production that represents about 5% of their domestic production. However, agriculture sector still remains its strategic importance to these two countries. As a consequence, both countries support their agriculture industries with subsidies on food export. This is particularly true for Finland, as more than 99% of export subsidy goes to its dairy industry. On the other hand, the loss on the dairy production in Finland due to the Russian embargo could be a concern. The simulation suggests that the embargo is going to reduce its production by 7.77%. In addition, the embargo further hurts the income of workers and firms of this industry. The crop-growing industry in Finland is vulnerable as well, given its geographic location. The industries such as: paddy rice, crops and cereal, tend to be more sensitive to the change in the demand of intermediate market. This simulation study results confirm the above observation. In Finland, the production of cereal grains and crops is more responsive to the decline of dairy production. For Germany, bovine meat production is the most affected industry with a reduction of 4.17%. In addition, the production of bovine cattle decreases by 3.45% as well. The decreased productions further lead to a loss of value income of 1376.33 million dollars. In summary, the negative effect caused by the embargo on these two industries is limited compared to the same industries in other studied regions in terms of percentage value. However, it causes the indirect effect on value added income of business service sector drops the most of all industries in this simulation due to the receipt of this service is more relied on the targeted productions. The embargo will cause a minor loss, 0.03%, on the GDP of Germany, which is negligible when facing such a giant economic entity.

Both Baltic States and Poland are the former communist countries within European Union. Their economic structures share a great deal of similarities. First, these two countries are experiencing a fast development on industrialization while their agriculture sector still remains its importance in the economic structure. Second, rent of land generates a large proportion of income to the value added outputs in their agriculture sectors. Poland, in particular has most of its farms privately owned and leased to tenants for productions. The hit on vegetable and fruit production in Poland and Baltic States will directly create a loss on the income of workers and land owners. Finally, the largest export from both regions to Russia is actually manufacturing products, for instance: chemical and plastic products and machinery and equipment products are the top two exported commodities exported from both two regions to Russia. Additionally, both regions rely on the oil import from Russia as well. 97.61% of imported oil in Baltic States is from Russia. A similar observation is seen in Poland, 92.13% of imported oil is from Russia. In addition, 99.97% of imported gas in Baltic States is from Russia as well. Therefore, it can be implied that, the threat on the economies of these two regions is not only from the food ban embargo, but also from the bilateral trade of energy and manufacturing products if Russia wants to do so. Finland and Germany share the similar situation but with slightly less severeness that 82.56% and 52.2% of imported oil are from Russia, respectively.

In conclusion, the impact of Russia's embargo on the economies of these four countries is moderate and negligible in terms of their change in GDP. Table 18 shows the loss of GDPs for four regions in the simulations. All the changes on GDP of four regions are less than 1%. The most affected region is Baltic States, which accounts for 0.44% of its GDP.

Table 18 The Loss of GDP in Simulations

Countries	The Loss of GDP in the Simulation
Baltic States	0.44%
Finland	0.13%
Poland	0.08%
Germany	0.03%

However, it does have some extent negative impacts on certain industries of each economy. The most affected industries in each region are: bovine meat production in Germany, vegetables and fruits production in both Baltic States and Poland, and dairy production in Finland. A summary of a comparison of simulation results of these four countries is presented in Table 19.

Table 19 Comparison Results of Most Affected Products in Four Studied Countries

Countries	The Most Affected Production	Change in Output (%)	The Most Affected Value Added Income	Loss in Value Added
Baltic States	Vegetables, fruit, nuts	-28.51%	Dairy products	-$158.88 million
Finland	Dairy products	-7.77%	Dairy products	-$101.87 million
Poland	Vegetables, fruit, nuts	-8.51%	Vegetables, fruit, nuts	-$229.53 million
Germany	Bovine meat products	-4.17%	Business service	-$206.60 million

The negative effects not only lead to production reductions but also lower the income of labors and firms in the business targeted by the Russian embargo. Since many previous import embargoes provide evidences that the import embargo tends to cause suboptimal recourse allocation, welfare loss, and harm to bilateral trade either on sanctioning country or on the targeted country. Golubkova (2014) has already showed that those economic sanctions from the EU and the US are believed to further weaken the Russian economy given the challenges that Russia has been facing recently. The economy of Russia enters into a recession with -2.2% of GDP for the first quarter of 2015 compared to the first quarter of 2014. On the other hand, this study shows that the Russian embargo is going to hurt certain industries and bilateral trade in the studied EU countries. In addition, In June 2015 the ban was extended to August 5th, 2016, and it may be subsequently extended for another 1-year period (Presidential Decree No. 391 dated July 29, 2015). Therefore, it is important for the policy makers in these affected European countries to have a clear understanding of the long-term effect on the countries economies and take steps to protect industries that most hurt by the Russian embargo.

Though the multiplier analysis can provide a holistic picture of impacts on each region's economy, it is important to note that the IO multipliers only considers the same spending response for all types of changes on final demand in the studied countries. Given the fixed proportion assumption, this study cannot be used to account for prices changes that may result from scarce resources. Under this assumption, the IO multiplier analysis tends to provide exaggerated results. In addition, the value of Input-Output multipliers is studied in an open economy, which considers households spending as a leakage and a part of final demand. Therefore, our study only analyzes the impact on production linkage and value added incomes. The induced effect caused by the household spending is not included in this study. At last, the effects of walk-around of the embargo, i.e., exporting products to a third country, e.g., Turkey, then re-export to Russia, cannot be observed from the analysis. Hence, it is outside the scope of this study.

As a further step, it is tempting to continue the Input-Output study by expanding its scope using CGE model based on social accounting matrix with multi-sectoral, multiclass

disaggregation. The advantage of this approach is that it includes multimarket models that can response to the relative price changes. In this case, the markets can reconcile supply and demand decisions in the CGE model.

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Appendix A Germany Aggregated Input-Output Table (2011)

Germany Input-Output Table (VDFM)	1 Agriculture	2 Manufacturing	3 Service	Total	Household Demand (VDPM)	Government Demand (VDGM)	Investisment Demand (cgds cf. VDFM)	Trade Taxes	Exportations Goods and services (VXWD)	Transport services (VST)	Total Output
1 Agriculture	70370.34	6273.07	16551.17	93194.58	169416.34	276.09	1645.68	394.97	79016.86		343944.53
2 Manufacturing	20014.02	759775.00	225342.17	1005131.19	319466.66	15470.92	422148.81	-0.50	1259603.17		3021820.25
3 Service	77704.72	499372.00	900102.06	1477178.78	1018260.75	651910.19	67457.84	0.00	186785.58	71151.62	3472744.75
Total	168089.08	1265420.07	1141995.41	2575504.55	1507143.75	667657.19	491252.33	394.47	1525405.62	71151.62	6838509.53
Land	5340.81	0.00	0.00	5340.81							5340.81
Capital	37329.45	266057.28	937916.31	1241303.05							1241303.05
Skilled Labour	22679.95	210878.14	534320.31	767878.40							767878.40
Unskilled Labour	30548.04	263173.44	278293.63	572015.10							572015.10
Natural resources	638.01	6018.08	0.00	6656.09							6656.09
Sales Taxes (Imports) (VIFA - VIFM)	318.08	4858.13	6350.88	11527.08							11527.08
Sales Taxes (domestic) (VDFA - VDFM)	1284.02	22616.25	34251.27	58151.53							58151.53
Factor User Taxes (EVFA - VFM)	22705.60	202175.79	351427.66	576309.05							576309.05
Production Taxes	10107.61	114178.09	8267.44	132553.14							132553.14
Imports (VIFM)	44903.89	666444.99	179921.85	891270.72							891270.72
Total Outlays	343944.53	3021820.25	3472744.75	6838509.53	1507143.75	667657.19	491252.33	394.47	1525405.62	71151.62	11101514.51

Appendix B Baltic States Aggregated Input-Output Table (2011)

Baltic States Input-Output Table (VDFM)	1 Agriculture	2 Manufacturing	3 Service	Total	Household Demand (VDPM)	Government Demand (VDGM)	Investment Demand (cgds cf. VDFM)	Trade Taxes	Exports Goods and services (VXWD)	Transport services (VST)	Total Output
1 Agriculture	4923.65	1072.69	1241.78	7238.11	13737.91	9.91	23.49	92.71	7576.34		28678.47
2 Manufacturing	2046.38	18764.69	9134.58	29945.65	7749.53	151.83	12768.27	0.14	37043.30		87658.72
3 Service	2260.31	7623.33	17353.20	27236.84	21334.03	18713.11	867.16	0.00	8979.90	7251.48	84382.51
Total	9230.34	27460.71	27729.55	64420.60	42821.46	18874.84	13658.92	92.85	53599.54	7251.48	200719.70
Land	849.01	0.00	0.00	849.01							849.01
Capital	8146.41	10091.06	21755.89	39993.37							39993.37
Natural Resources	198.70	586.86	0.00	785.56							785.56
Skilled Labour	864.88	3777.31	11987.27	16629.47							16629.47
Unskilled Labour	2652.34	6386.14	3968.34	13006.82							13006.82
Sales Taxes (Imports) (VIFA - VIFM)	69.82	24.85	869.16	963.82							963.82
Sales Taxes (domestic) (VDFA - VDFM)	46.45	102.65	763.12	912.22							912.22
Factor User Taxes (EVFA - VFM)	1049.31	3102.89	4819.71	8971.91							8971.91
Production Taxes	951.62	4149.33	329.36	5430.31							5430.31
Imports (VIFM)	4619.60	31976.91	12160.11	48756.61							48756.61
Total Outlays	28678.47	87658.72	84382.52	200719.70	42821.46	18874.84	13658.92	92.85	53599.54	7251.48	337018.80

Appendix C Finland Aggregated Input-Output Table (2011)

Finland Input-Output Table (VDFM)	1 Agriculture	2 Manufacturing	3 Service	Total	Household Demand (VDPM)	Government Demand (VDGM)	Investment Demand cgds cf. (VDFM)	Trade Taxes	Exports Goods and services (VXWD)	Transport services (VST)	Total Output
1 Agriculture	7565.90	5062.77	3669.98	16298.66	9374.92	26.32	7.85	104.40	2885.19		28697.34
2 Manufacturing	2867.87	82143.66	40828.58	125840.10	19005.60	33.56	36449.07	-0.09	72386.74		253714.98
3 Service	3308.85	25682.50	55656.61	84647.96	77604.25	65141.21	9354.57	0.00	19566.08	2623.91	258937.98
Total	13742.62	112888.93	100155.17	226786.72	105984.77	65201.09	45811.49	104.31	94838.02	2623.91	541350.31
Land	296.56	0.00	0.00	296.56							296.56
Capital	4542.04	30385.36	56531.05	91458.45							91458.45
Natural Resources	432.47	185.45	0.00	617.92							617.92
Skilled Labor	1850.53	19000.86	49249.05	70100.44							70100.44
Unskilled Labor	2664.61	16644.19	23218.47	42527.27							42527.27
Sales Taxes (Imports) (VIFA - VIFM)	39.53	304.50	312.61	656.64							656.64
Sales Taxes (domestic) (VDFA - VDFM)	217.85	1436.35	2300.06	3954.26							3954.26
Factor User Taxes (EVFA - VFM)	404.09	3370.61	6803.81	10578.50							10578.50
Production Taxes	1300.36	16074.20	195.31	17569.87							17569.87
Imports (VIFM)	3206.70	53424.54	20172.45	76803.69							76803.69
Total Outlays	28697.35	253714.98	258937.98	541350.31	105984.77	65201.09	45811.49	104.31	94838.02	2623.91	855913.90

Appendix D Poland Aggregated Input-Output Table (2011)

Poland Input-Output Table (VDFM)	1 Agriculture	2 Manufacturing	3 Service	Total	Household Demand (VDPM)	Government Demand (VDGM)	Investment Demand (cgds cf. VDFM)	Trade Taxes	Exportations		Total Output
									Goods and services (VXWD)	Transport services (VST)	
1 Agriculture	39182.73	5595.02	12984.48	57762.23	49321.13	40.09	4.53	132.19	20282.96		127543.13
2 Manufacturing	14178.10	155263.17	68068.17	237509.44	63559.93	50.52	70295.99	-0.39	149184.13		520599.63
3 Service	12777.82	49769.32	101826.55	164373.70	137681.20	97461.23	14069.56	0.00	20913.30	13968.66	448467.65
Total	66138.65	210627.52	182879.20	459645.37	250562.26	97551.85	84370.08	131.80	190380.39	13968.66	1096610.40
Land	3663.81	0.00	0.00	3663.81							3663.81
Capital	11697.65	84185.89	109597.20	205480.74							205480.74
Natural Resources	427.08	2272.56	0.00	2699.64							2699.64
Skilled Labour	3973.74	23621.38	58226.54	85821.67							85821.67
Unskilled Labour	9840.80	35947.46	19974.20	65762.47							65762.47
Sales Taxes (Imports) (VIFA - VIFM)	87.53	184.61	588.39	860.53							860.53
Sales Taxes (domestic) (VDFA - VDFM)	688.02	1474.78	4434.62	6597.42							6597.42
Factor User Taxes (EVFA - VFM)	6535.86	28648.17	37549.86	72733.90							72733.90
Production Taxes	7695.23	19839.59	357.27	27892.08							27892.08
Imports (VIFM)	16794.75	113797.67	34860.38	165452.80							165452.80
Total Outlays	127543.13	520599.63	448467.66	1096610.41	250562.26	97551.85	84370.08	131.80	190380.39	13968.66	1733575.45

Appendix E Simulation Results of Germany (3 pages)

Item	Total output	Change in output	New Output	% Change	Value Added Share	New VA
Paddy rice	40.59176	-0.159112119	40.43265	-0.39%	0.443692059	17.93964522
Wheat	6829.78978	-16.519781	6813.27000	-0.24%	0.612246244	4171.398965
Cereal grains	3985.66713	-13.88466862	3971.78246	-0.35%	0.653897003	2597.136648
Vegetables, fruit, nuts	5114.27342	-83.64758133	5030.62583	-1.64%	0.693509545	3488.787033
Oil seeds	2576.62828	-20.59461493	2556.03366	-0.80%	0.644031833	1646.167043
Sugar cane, sugar beet	1099.06555	-0.829504222	1098.23604	-0.08%	0.635686286	698.1335926
Plant-based fibers	82.63959	-0.013775231	82.62581	-0.02%	0.428933433	35.44097263
Crops	15456.16628	-11.76473173	15444.40155	-0.08%	0.661900449	10222.65633
Bovine cattle, sheep and goats, horses	4645.43278	-160.2110022	4485.22178	-3.45%	0.347431842	1558.308863
Animal products	14033.61845	-271.5310316	13762.08741	-1.93%	0.465663712	6408.504705
Raw milk	14457.83083	-126.6242447	14331.20658	-0.88%	0.750536721	10756.09679
Wool, silk-worm cocoons	53.20151	-0.004178295	53.19733	-0.01%	0.429722199	22.86007306
Forestry	5832.13815	-2.288884478	5829.84926	-0.04%	0.640117419	3731.788065
Fishing	1167.60890	-0.546401946	1167.06249	-0.05%	0.781957005	912.592693
Coal	10523.66194	-1.562038559	10522.09990	-0.01%	0.399910821	4207.901606
Oil	2273.22003	-0.243869193	2272.97616	-0.01%	0.871612744	1981.154986
Gas	763.50634	-0.011560263	763.49478	0.00%	0.783786154	598.4166379
Minerals	11471.00584	-3.896450986	11467.10939	-0.03%	0.601713766	6899.91758
Bovine meat products	7559.04290	-314.922091	7244.12081	-4.17%	0.448615822	3249.82721
Meat products	18020.81136	-426.1681852	17594.64318	-2.36%	0.401353987	7061.680189

Vegetable oils and fats	5507.43816	-95.05927098	5412.37889	-1.73%	0.61351045	3320.551006
Dairy products	48763.40848	-528.7005286	48234.70795	-1.08%	0.278141162	13416.05773
Processed rice	632.58908	-0.066000694	632.52308	-0.01%	0.804972699	509.1638129
Sugar	3140.03637	-2.786959549	3137.24941	-0.09%	0.590982951	1854.060917
Food products	119442.05961	-45.26817224	119396.79144	-0.04%	0.547961986	65424.90296
Beverages and tobacco products	65504.50336	-3.181057138	65501.32230	0.00%	0.516442541	33827.66933
Textiles	34871.13069	-0.394802484	34870.73589	0.00%	0.64548911	22508.68029
Wearing apparel	32718.65091	-0.197902317	32718.45301	0.00%	0.653336789	21376.16902
Leather products	11942.30044	-0.083575609	11942.21686	0.00%	0.680604542	8127.927034
Wood products	49003.42259	-3.182482988	49000.24011	-0.01%	0.549023205	26902.26885
Paper products, publishing	135362.19347	-17.94032435	135344.25314	-0.01%	0.514063499	69575.54031
Petroleum, coal products	194441.86010	-20.93447771	194420.92562	-0.01%	0.744101881	144668.9764
Chemical, rubber, plastic products	389203.24204	-17.21706657	389186.02498	0.00%	0.583010645	226899.5953
Mineral products	67258.38588	-7.166484621	67251.21940	-0.01%	0.55736818	37483.68974
Ferrous metals	76106.72332	-1.814232534	76104.90909	0.00%	0.524637867	39927.51719
Metals	62980.52319	-0.837708245	62979.68548	0.00%	0.651345643	41021.54374
Metal products	171030.40675	-9.474509396	171020.93224	-0.01%	0.599815904	102581.0751
Motor vehicles and parts	445018.98505	-3.680624731	445015.30443	0.00%	0.487789123	217073.6249
Transport equipment	68419.47828	-0.337688644	68419.14059	0.00%	0.605325251	41415.83343
Electronic equipment	89070.60688	-1.168181214	89069.43870	0.00%	0.628561605	55985.62935
Machinery and equipment	629869.32768	-15.1865598	629854.14112	0.00%	0.598118379	376727.3377
Manufactures	65047.77280	-0.983674739	65046.78913	0.00%	0.556844286	36220.93284
Electricity	104449.10651	-15.19864968	104433.90786	-0.01%	0.588015633	61408.77042

Gas manufacture, distribution	3694.11331	-0.334016422	3693.77930	-0.01%	0.642613155	2373.671169
Water	16003.06007	-7.307765629	15995.75230	-0.05%	0.675777319	10809.5666
Construction	350297.47745	-12.23123176	350285.24622	0.00%	0.569648612	199539.5042
Trade	440120.47352	-56.25521628	440064.21830	-0.01%	0.737727293	324647.3847
Transport	237231.15436	-61.27564582	237169.87871	-0.03%	0.467686908	110921.2473
Water transport	68049.61151	-1.255133869	68048.35638	0.00%	0.512608127	34882.14049
Air transport	58513.67876	-2.679523185	58510.99924	0.00%	0.469814609	27489.32225
Communication	120371.99145	-14.17164766	120357.81980	-0.01%	0.575598514	69277.78217
Financial services	219022.27874	-47.91243522	218974.36630	-0.02%	0.556561787	121872.7646
Insurance	100543.94793	-13.77039094	100530.17754	-0.01%	0.329556825	33130.4061
Business services	852428.92068	-319.0668566	852109.85382	-0.04%	0.647593178	551820.5278
Recreational and other services	189397.20267	-15.95817364	189381.24449	-0.01%	0.67820443	128439.1989
Public Administration, Defense, Education, Health	907873.90851	-50.61832172	907823.29019	-0.01%	0.748621667	679616.1849
Dwellings	279191.54229	-1.194652577	279190.34764	0.00%	0.889301966	248284.5251
SUM						4261628.453
Original GDP	4263004.97900		Change in GDP	-0.03%		

Appendix F Simulation Results of Baltic States (3 pages)

Item	Total output	Change in output	New Output	% Change	Value Added Share	New VA
Paddy rice	2.81	-0.05	2.76	-1.77%	68.95%	1.90
Wheat	764.69	-3.30	761.39	-0.43%	68.69%	523.01
Cereal grains nec	458.84	-5.22	453.62	-1.14%	71.06%	322.33
Vegetables, fruit, nuts	417.32	-118.97	298.35	-28.51%	71.65%	213.78
Oil seeds	467.45	-0.15	467.30	-0.03%	75.09%	350.89
Sugar cane, sugar beet	48.27	-0.08	48.18	-0.17%	81.97%	39.50
Plant-based fibers	8.07	0.00	8.06	-0.04%	78.36%	6.32
Crops nec	1649.76	-9.26	1640.50	-0.56%	78.57%	1288.90
Bovine cattle, sheep and goats, horses	196.39	-9.47	186.92	-4.82%	39.06%	73.02
Animal products nec	679.53	-94.94	584.59	-13.97%	77.02%	450.23
Raw milk	1103.22	-43.27	1059.95	-3.92%	51.72%	548.19
Wool, silk-worm cocoons	3.23	-0.03	3.20	-0.93%	94.04%	3.01
Forestry	2017.13	-1.12	2016.01	-0.06%	63.23%	1274.73
Fishing	404.14	-7.13	397.01	-1.76%	66.78%	265.12
Coal	88.74	-0.18	88.56	-0.20%	26.86%	23.79
Oil	2508.48	-6.79	2501.69	-0.27%	78.07%	1953.18
Gas	38.40	-0.14	38.26	-0.36%	38.33%	14.67
Minerals nec	566.91	-0.69	566.22	-0.12%	69.45%	393.26
Bovine meat products	756.56	-90.43	666.14	-11.95%	82.03%	546.46
Meat products nec	2167.12	-25.18	2141.94	-1.16%	77.86%	1667.79
Vegetable oils and fats	243.19	-1.44	241.75	-0.59%	67.52%	163.22
Dairy products	6625.38	-341.41	6283.98	-5.15%	46.54%	2924.34
Processed rice	22.53	-0.02	22.52	-0.07%	63.06%	14.20
Sugar	466.49	-0.73	465.76	-0.16%	80.81%	376.37
Food products nec	7761.83	-20.44	7741.38	-0.26%	77.70%	6015.15

Beverages and tobacco products	2414.51	-0.63	2413.89	-0.03%	78.95%	1905.64
Textiles	1975.26	-0.47	1974.79	-0.02%	75.48%	1490.56
Wearing apparel	2281.70	-0.61	2281.09	-0.03%	76.34%	1741.33
Leather products	907.25	-0.08	907.16	-0.01%	69.79%	633.13
Wood products	6884.93	-3.84	6881.09	-0.06%	58.15%	4001.51
Paper products, publishing	3258.14	-13.26	3244.88	-0.41%	62.80%	2037.79
Petroleum, coal products	12155.11	-10.16	12144.95	-0.08%	73.42%	8916.47
Chemical, rubber, plastic products	12600.43	-21.05	12579.38	-0.17%	64.76%	8146.53
Mineral products nec	1944.33	-4.01	1940.32	-0.21%	66.20%	1284.51
Ferrous metals	2282.43	-0.54	2281.88	-0.02%	70.64%	1612.04
Metals nec	841.29	-0.32	840.97	-0.04%	72.99%	613.87
Metal products	3072.12	-5.64	3066.48	-0.18%	74.27%	2277.35
Motor vehicles and parts	2192.35	-0.18	2192.17	-0.01%	76.68%	1681.00
Transport equipment nec	1174.71	-0.81	1173.90	-0.07%	70.87%	831.93
Electronic equipment	3415.11	-0.29	3414.81	-0.01%	84.87%	2898.00
Machinery and equipment nec	6533.21	-2.10	6531.12	-0.03%	76.71%	5009.75
Manufactures nec	1636.26	-1.11	1635.16	-0.07%	61.81%	1010.65
Electricity	6462.73	-18.98	6443.75	-0.29%	57.29%	3691.67
Gas manufacture, distribution	156.04	-1.29	154.75	-0.83%	7.80%	12.07
Water	678.98	-2.20	676.78	-0.32%	74.82%	506.34
Construction	14003.81	-4.84	13998.97	-0.03%	66.80%	9351.65
Trade	10419.58	-21.10	10398.48	-0.20%	56.48%	5872.96
Transport nec	16241.77	-19.27	16222.50	-0.12%	61.13%	9917.19
Water transport	3741.59	-0.91	3740.69	-0.02%	62.04%	2320.91
Air transport	1182.03	-0.73	1181.30	-0.06%	57.72%	681.90
Communication	4871.43	-9.45	4861.99	-0.19%	72.88%	3543.31

Financial services nec	3543.27	-8.24	3535.03	-0.23%	57.12%	2019.07
Insurance	819.03	-1.54	817.49	-0.19%	57.08%	466.62
Business services nec	10852.02	-26.70	10825.32	-0.25%	64.77%	7011.58
Recreational and other services	4718.08	-3.64	4714.44	-0.08%	62.51%	2946.88
Public Administration, Defense, Education, Health	23020.95	-6.08	23014.86	-0.03%	74.90%	17237.88
Dwellings	4972.77	-0.06	4972.70	0.00%	91.97%	4573.32
SUM						**135698.75**
Original GDP	**136299.10**		Change in GDP	-0.44%		

Appendix G Simulation Results of Finland (3 pages)

Item	Total output	Change in output	New Output	% Change	Value Added Share	New VA
Paddy rice	2.58	-0.06	2.52	-2.47%	39.37%	0.99
Wheat	211.98	-1.40	210.58	-0.66%	52.85%	111.29
Cereal grains nec	576.56	-10.60	565.95	-1.84%	49.94%	282.66
Vegetables, fruit, nuts	989.46	-20.59	968.86	-2.08%	62.62%	606.74
Oil seeds	78.09	-0.34	77.75	-0.44%	55.72%	43.32
Sugar cane, sugar beet	25.45	-0.12	25.33	-0.48%	50.98%	12.91
Plant-based fibers	3.23	0.00	3.23	-0.03%	72.93%	2.36
Crops nec	489.64	-5.27	484.37	-1.08%	56.06%	271.54
Bovine cattle, sheep and goats, horses	262.42	-6.48	255.94	-2.47%	34.53%	88.37
Animal products nec	1126.17	-65.50	1060.68	-5.82%	53.12%	563.38
Raw milk	1398.63	-99.03	1299.60	-7.08%	77.32%	1004.80
Wool, silk-worm cocoons	0.66	0.00	0.66	-0.07%	38.54%	0.25
Forestry	4864.62	-2.23	4862.39	-0.05%	77.10%	3748.87
Fishing	379.17	-8.16	371.01	-2.15%	65.52%	243.10
Coal	487.37	-0.76	486.61	-0.16%	58.43%	284.31
Oil	35.66	-0.04	35.62	-0.11%	41.43%	14.75
Gas	0.02	0.00	0.02	-0.10%	43.65%	0.01
Minerals nec	1546.07	-0.42	1545.65	-0.03%	51.44%	795.03
Bovine meat products	987.84	-10.65	977.20	-1.08%	39.53%	386.24
Meat products nec	1167.39	-24.71	1142.68	-2.12%	27.20%	310.86
Vegetable oils and fats	204.27	-1.30	202.97	-0.63%	64.93%	131.79

Dairy products	5835.90	-453.60	5382.30	-7.77%	22.46%	1208.80
Processed rice	40.83	-0.02	40.81	-0.04%	38.04%	15.52
Sugar	245.66	-1.49	244.18	-0.61%	65.65%	160.31
Food products nec	6945.03	-35.63	6909.40	-0.51%	54.04%	3733.58
Beverages and tobacco products	2861.76	-3.37	2858.39	-0.12%	61.16%	1748.30
Textiles	1551.55	-0.29	1551.26	-0.02%	68.28%	1059.12
Wearing apparel	1679.21	-0.89	1678.33	-0.05%	72.41%	1215.22
Leather products	661.02	-0.10	660.93	-0.01%	70.14%	463.60
Wood products	8456.75	-2.22	8454.52	-0.03%	37.64%	3182.49
Paper products, publishing	31386.82	-21.23	31365.59	-0.07%	46.38%	14546.53
Petroleum, coal products	36561.52	-39.52	36522.00	-0.11%	62.17%	22707.49
Chemical, rubber, plastic products	20179.28	-13.51	20165.76	-0.07%	55.52%	11195.08
Mineral products nec	4709.95	-2.92	4707.03	-0.06%	57.11%	2688.35
Ferrous metals	12981.87	-1.82	12980.05	-0.01%	47.61%	6179.66
Metals nec	6687.65	-0.97	6686.68	-0.01%	58.71%	3925.55
Metal products	8318.42	-4.07	8314.36	-0.05%	58.47%	4861.72
Motor vehicles and parts	4180.57	-0.33	4180.23	-0.01%	79.03%	3303.49
Transport equipment nec	3907.79	-0.17	3907.62	0.00%	52.68%	2058.59
Electronic equipment	17534.80	-4.81	17530.00	-0.03%	51.93%	9102.82
Machinery and equipment nec	35334.34	-10.53	35323.82	-0.03%	56.46%	19942.15
Manufactures nec	2948.40	-0.73	2947.67	-0.02%	57.53%	1695.76
Electricity	15312.98	-21.71	15291.27	-0.14%	64.00%	9786.77
Gas manufacture, distribution	7.38	-0.01	7.37	-0.08%	70.48%	5.19

Water	798.30	-0.53	797.77	-0.07%	79.27%	632.42
Construction	38447.27	-2.93	38444.33	-0.01%	54.90%	21104.97
Trade	30881.92	-8.59	30873.33	-0.03%	22.97%	7090.31
Transport nec	23403.73	-24.48	23379.24	-0.10%	54.98%	12853.24
Water transport	3600.76	-0.26	3600.50	-0.01%	47.77%	1719.96
Air transport	3862.56	-1.62	3860.94	-0.04%	43.43%	1676.89
Communication	12501.88	-8.15	12493.73	-0.07%	69.37%	8666.39
Financial services nec	11126.37	-8.21	11118.17	-0.07%	69.73%	7752.93
Insurance	5089.64	-2.91	5086.73	-0.06%	79.13%	4024.90
Business services nec	51386.95	-52.05	51334.90	-0.10%	58.89%	30232.04
Recreational and other services	11647.61	-1.56	11646.05	-0.01%	61.39%	7149.24
Public Administration, Defense, Education, Health	81188.68	-6.84	81181.84	-0.01%	71.74%	58237.71
Dwellings	24247.87	-0.07	24247.80	0.00%	79.65%	19312.67
SUM						**314143.34**
Original GDP	**314563.59**		Change in GDP	-0.13%		

Appendix H Simulation Results of Poland (3 pages)

Item	Total output	Change in output	New Output	% Change	Value Added Share	New VA
Paddy rice	7.61	-0.05	7.56	-0.65%	41.03%	3.10
Wheat	2324.91	-3.21	2321.70	-0.14%	65.97%	1531.53
Cereal grains nec	3433.20	-9.88	3423.32	-0.29%	51.72%	1770.42
Vegetables, fruit, nuts	6021.34	-512.20	5509.13	-8.51%	44.81%	2468.74
Oil seeds	1147.70	-0.61	1147.09	-0.05%	67.63%	775.77
Sugar cane, sugar beet	593.74	-0.23	593.51	-0.04%	69.94%	415.11
Plant-based fibers	6.90	-0.01	6.89	-0.08%	87.42%	6.02
Crops nec	2124.30	-3.95	2120.35	-0.19%	68.31%	1448.39
Bovine cattle, sheep and goats, horses	1087.88	-18.49	1069.38	-1.70%	30.85%	329.90
Animal products nec	7469.45	-29.75	7439.70	-0.40%	56.10%	4173.95
Raw milk	4185.37	-11.11	4174.25	-0.27%	47.78%	1994.44
Wool, silk-worm cocoons	1.37	0.00	1.37	-0.15%	39.45%	0.54
Forestry	4847.95	-1.81	4846.14	-0.04%	56.84%	2754.62
Fishing	704.92	-1.32	703.60	-0.19%	53.76%	378.23
Coal	8039.23	-8.80	8030.42	-0.11%	67.31%	5405.57
Oil	518.94	-0.49	518.45	-0.09%	42.62%	220.98
Gas	8.83	-0.01	8.82	-0.07%	40.19%	3.55
Minerals nec	3610.81	-1.75	3609.06	-0.05%	60.30%	2176.39
Bovine meat products	3256.42	-55.74	3200.69	-1.71%	38.27%	1224.85
Meat products nec	17007.44	-32.56	16974.88	-0.19%	28.95%	4913.38
Vegetable oils and fats	1910.48	-1.83	1908.65	-0.10%	74.43%	1420.60
Dairy products	33604.84	-106.62	33498.21	-0.32%	44.54%	14921.28
Processed rice	100.11	-0.02	100.10	-0.02%	38.96%	39.00
Sugar	4540.82	-1.63	4539.19	-0.04%	74.23%	3369.47
Food products nec	23784.53	-30.04	23754.48	-0.13%	47.29%	11233.43

Beverages and tobacco products	9381.87	-1.80	9380.06	-0.02%	62.54%	5866.04
Textiles	5007.67	-0.34	5007.33	-0.01%	70.31%	3520.61
Wearing apparel	8825.59	-0.78	8824.81	-0.01%	64.91%	5727.85
Leather products	2747.25	-0.13	2747.12	0.00%	65.22%	1791.78
Wood products	21089.44	-4.99	21084.45	-0.02%	51.57%	10873.66
Paper products, publishing	28138.39	-12.31	28126.07	-0.04%	53.18%	14956.52
Petroleum, coal products	37393.11	-35.52	37357.59	-0.10%	74.75%	27923.93
Chemical, rubber, plastic products	59079.88	-24.55	59055.34	-0.04%	59.25%	34990.20
Mineral products nec	21777.13	-11.48	21765.65	-0.05%	59.11%	12865.06
Ferrous metals	16623.90	-4.40	16619.49	-0.03%	53.08%	8821.71
Metals nec	14728.57	-1.98	14726.59	-0.01%	64.82%	9545.07
Metal products	26182.32	-13.96	26168.36	-0.05%	59.06%	15454.83
Motor vehicles and parts	38473.60	-2.15	38471.45	-0.01%	66.38%	25536.60
Transport equipment nec	9398.99	-0.76	9398.22	-0.01%	51.62%	4851.71
Electronic equipment	17527.76	-0.78	17526.98	0.00%	64.49%	11303.13
Machinery and equipment nec	52731.03	-19.38	52711.65	-0.04%	61.85%	32602.80
Manufactures nec	9844.73	-2.02	9842.70	-0.02%	55.60%	5473.02
Electricity	32458.82	-19.38	32439.44	-0.06%	49.01%	15897.06
Gas manufacture, distribution	1022.22	-0.52	1021.69	-0.05%	54.43%	556.07
Water	3051.31	-2.07	3049.24	-0.07%	71.47%	2179.35
Construction	102320.12	-13.68	102306.44	-0.01%	55.89%	57183.43
Trade	51047.29	-11.06	51036.23	-0.02%	18.37%	9372.91
Transport nec	56680.73	-19.59	56661.14	-0.03%	49.49%	28039.59
Water transport	3327.91	-0.21	3327.70	-0.01%	44.79%	1490.56

Air transport	3159.12	-0.51	3158.60	-0.02%	40.23%	1270.64
Communication	23234.49	-8.34	23226.14	-0.04%	53.32%	12383.40
Financial services nec	24151.73	-6.54	24145.19	-0.03%	54.35%	13122.06
Insurance	6815.27	-7.27	6808.00	-0.11%	75.32%	5127.97
Business services nec	94625.84	-46.71	94579.12	-0.05%	54.00%	51076.47
Recreational and other services	29225.35	-3.73	29221.62	-0.01%	61.79%	18057.05
Public Administration, Defense, Education, Health	112957.24	-9.51	112947.73	-0.01%	78.96%	89188.92
Dwellings	43242.69	-0.07	43242.62	0.00%	84.17%	36398.26
SUM						**636427.56**
Original GDP	**636965.05**		Change in GDP	-0.08%		